UNITED STATES AIR FORCE

AIR UNIVERSITY

AIR FORCE INSTITUTE OF TECHNOLOGY

Wright-Patterson Air Force Base, Ohio

103

AN ANALYSIS OF DOD/NASA CONTRACTOR PROFITABILITY IN THE INCENTIVE CONTRACT ENVIRONMENT

THESIS

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Unclassified
Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author)	2a. REPORT SECURITY CLASSIFICATION
Air Force Institute of Technology (AFIT-EN) Wright-Patterson AFB, Ohio 45433	Unclassified
	2b. GROUP

3. REPORT TITLE

AN ANALYSIS OF DOD/NASA CONTRACTOR PROFITABILITY IN THE INCENTIVE CONTRACT ENVIRONMENT

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)

AFIT Thesis

5. AUTHOR(S) (First name, middle initial, last name)

Jerry E. Trimble
Captain USAF

6. REPORT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
October 1971	100	30

8a. CONTRACT OR GRANT NO.	9a. ORIGINATOR'S REPORT NUMBER(S)
None b. PROJECT NO.	GSM/SM/71-12
c.	9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)
d.	

10. DISTRIBUTION STATEMENT

Distribution of this document is unlimited.

11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY

13. ABSTRACT

This research evaluates the results of the increased use of incentive-type contracts by the Department of Defense and the National Aeronautics and Space Administration. The efficiency and productivity resulting from the use of capital and labor resources by the defense and space firms are compared over a period of time with a group of similar firms having purely commercial business. The comparison is made with the following financial indicators: returns on sales, equity capital and total assets, equity capital turnover, total assets turnover, and sales dollars per employee.

This analysis shows that the intensified incentive environment has failed to induce defense and NASA contractors toward increased efficiency and productivity in the use of capital and labor resources. These firms as a group are less profitable and show a less favorable financial status than purely commercial firms.

DD FORM 1 NOV 65 1473

Unclassified
Security Classification

Unclassified
Security Classification

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Defense Procurement						
Government Contracts						
Automatic Incentives						
Cost Reduction						
Department of Defense						
National Aeronautics and Space Administration						
President John F. Kennedy						
Robert S. McNamara						
Military-Industrial Complex						
Commercial Business						
Cost Overrun						
Renegotiation						
Resources						
Incentives						
Profits						

Unclassified
Security Classification

GSM/SM/71-12

AN ANALYSIS OF DOD/NASA CONTRACTOR PROFITABILITY IN THE INCENTIVE CONTRACT ENVIRONMENT

THESIS

Presented to the Faculty of the School of Engineering
of the Air Force Institute of Technology

Air University

in Partial Fulfillment of the
Requirements for the Degree of

Master of Science

by

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Captain USAF

Graduate Systems Management

October 1971

Preface

The writing of this thesis presents a rare opportunity to acknowledge special recognition to the United States Air Force for the many excellent educational opportunities that are available to all Air Force members. I am especially indebted to the Air Force for my undergraduate and graduate education, both of which were sponsored by the Air Force Institute of Technology.

This research has involved the time, effort and sacrifice of several persons other than myself. My acknowledgement of sincere appreciation is given to Lieutenant Colonel David L. Belden for his patience, constructive advice and guidance as my thesis advisor. Recognition of my sincere appreciation is also given to Lieutenant Colonel Charles J. Doryland for his particular interest and guidance concerning this research, and as my faculty advisor. This thesis is dedicated to my wife, Janice, for her very special understanding and encouragement and typing thesis drafts. To our children, Jacqueline, Julia and Forrest, I have a very special appreciation for their understanding of the loss in family life during this research process and for the duration of my graduate education.

Jerry E. Trimble

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mercial business which are listed in Fortune's Directory of the 500 Largest Industrials. Comparison of the two groups of firms is based upon average annual financial indicators including returns on sales, equity capital and total assets, total assets turnover, equity capital turnover, and sales dollars per employee. Annual averages of these indicators are plotted for each group of firms.

The hypothesis that the group of firms, each of which had more than 50 per cent of total sales revenues from DOD and NASA sales, would exhibit an increase in the annual averages of the financial indicators relative to those of the group having only commercial sales was rejected upon the year to year comparisons and trend analyses of the graphs. The "incentive environment" has failed to induce defense and NASA contractors toward increased efficiency and productivity in the use of capital and labor resources.

AN ANALYSIS OF DOD/NASA CONTRACTOR PROFITABILITY IN THE INCENTIVE CONTRACT ENVIRONMENT

I. Introduction

Throughout United States history there has been a continuous interest in and controversy over the Government's procedures for acquiring products and services. Much of this controversy has arisen over contractors' profits and total costs to the Government or the eventual cost to each U.S. taxpayer. Firm-fixed-price and incentive contracts are being used in government procurement in an attempt to obtain better products and to limit or reduce total costs. This research is an examination of the results of the significant increase in the use of incentive contracts which occurred during the 1960's. The purpose is to determine if these profit incentives have induced the contractors to be more efficient in using total resources.

The Environment

President Kennedy said in his inaugural address: "Only when our arms are sufficient beyond doubt can we be certain beyond doubt that they will never be employed."

(Ref 33:47) Robert S. McNamara accepted the office of Secretary of Defense in January 1961 and the task of providing a detailed blueprint of the Kennedy defense program. President Kennedy's instructions to Secretary McNamara included :

> Develop the force structure necessary to our military requirements without regard to arbitrary or predetermined budget ceilings, and having determined that force structure, ... procure it at the lowest possible cost. (Ref 33:48)

Secretary McNamara directed the military services to assure that Defense procurement was guided by the following policies:

> 1. The first and paramount objective is to acquire weapons and material which fully meet qualitative and delivery requirements---at the lowest overall cost.
> 2. Full and free competition with equal opportunity to all interested qualified suppliers must be stressed. Sole source procurement must be continuously minimized. Whenever specifications are sufficiently precise, competition must be obtained through formal advertised bidding procedures as required by law. (Ref 79:206-207)

Secretary McNamara established two principal objectives: to shift defense procurement from noncompetitive to competitive; and to shift from cost-plus-fixed-fee (CPFF) to firm-fixed-price (FFP) and incentive contracts.

The firm-fixed-price contract is the type preferred by the Government. It theoretically provides incentives to control costs since the difference in the final cost and the fixed-price is the contractors' profit or loss. The contractors receive all rewards or penalties from risks. Incentive contracts with specified risk and profit sharing

formulas are preferred where FFP contracts are not suitable.

Secretary McNamara's objectives were designed to deal with the problems resulting from the demand for electronics, missiles, and other technically advanced systems which increased rapidly in the 1950's. Risks involved in developing and producing these weapon systems caused a rapid decrease in the number of FFP contracts that were used and a corresponding increase in the use of CPFF contracts. The increased use of CPFF contracts allegedly resulted in large cost overruns mainly because they contain no incentives for cost control or efficient use of resources. (Ref 79:207-208)

The Armed Services Procurement Regulation (ASPR) authorizes and limits the type contracts that are available for defense procurement. Federal Procurement Regulations (FPR) control procurements by civilian federal executive agencies. The National Aeronautics and Space Administration Procurement Regulation (NASA PR), published under the FPR system, is based on the National Aeronautics and Space Act and the Armed Forces Procurement Act. NASA PR policies and procedures are nearly consistent with those adopted by the DOD in the ASPR, since both agencies are controlled by the same procurement law and generally deal with the same segment of industry. (Ref 17:32-37)

The two major classifications of contract types are fixed-price contracts and cost-reimbursable contracts.

Considering contractor's responsibility for cost, the contract types range between the two extremes of firm-fixed-price and cost-plus-fixed-fee. The major types of contracts are listed below and are briefly explained in Appendix A:

1. Fixed-price contracts
    a. Firm-fixed-price (FFP)
    b. Fixed-price-redeterminable (FPR)
    c. Fixed-price-incentive (FPI)
        (1) Fixed-price-incentive-firm (FPIF)
        (2) Fixed-price-incentive-successive (FPIS)
2. Cost-reimbursable contracts
    a. Cost-plus-fixed-fee (CPFF)
    b. Cost-plus-incentive-fee (CPIF)

The word "incentive" refers to contractual provisions which relate variable contractor profit or fee to actual cost, time schedules, or performance level of the product.

The results of the emphasis on fixed-price and incentive contracting are dramatic. Detailed results for the 1959 - 1970 period are included in Tables I, II, and III. Tables I and III provide the dollar value of each contract type awarded annually as a percentage of total DOD and NASA contract dollars awarded, respectively. Table II presents the number of DOD contracts of each type awarded annually as a percentage of the total number of DOD contracts awarded.

For the DOD, the percentage of contract dollars covered by FFP and incentive contracts increased markedly, while the percentage of contract dollars covered by fixed-fee contracts substantially decreased. The fixed-

Table I

DOD AWARDS BY TYPE OF CONTRACT PRICING PROVISION

AS A PERCENTAGE OF TOTAL CONTRACT DOLLARS (FY 1959-1970)[a]

Types of Contract[b]	Percentage by Fiscal Years											
	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
Fixed-Price (Sub-Total)	59.1%	57.4%	57.9%	60.8%	64.9%	71.2%	76.5%	79.2%	78.9%	77.6%	75.8%	74.0%
Firm	32.8	31.4	31.5	38.0	41.5	46.3	52.8	57.5	56.3	52.7	50.2	47.5
Incentive	15.3	13.6	11.2	12.0	15.8	18.5	16.6	15.9	17.8	18.7	19.7	20.9
Other[c]	11.0	12.4	15.2	10.8	7.6	6.4	7.1	5.8	4.8	6.2	5.9	5.6
Cost Reimbursement (Sub-Total)	40.9	42.6	42.1	39.2	35.1	28.8	23.5	20.8	21.1	22.4	24.2	26.0
Incentive	3.2	3.2	3.2	4.1	11.7	14.1	11.2	8.3	8.3	9.0	9.3	9.8
Fixed Fee	34.2	36.8	36.6	32.5	20.7	12.0	9.4	9.9	10.4	10.8	9.6	10.4
Other[d]	3.4	2.6	2.3	2.6	2.7	2.7	2.9	2.6	2.4	2.6	5.3	5.8
Total Percent	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Total Dollars (In Billions)	$22.9	$21.2	$22.9	$25.8	$26.2	$25.3	$24.3	$33.5	$39.2	$39.1	$37.2	$36.0

[a] Source: Military Prime Contract Awards, various issues. (Ref 70)
[b] Represents procurement actions of $10,000 or more excluding Intragovernmental.
[c] Includes Redeterminable and Escalation contracts.
[d] Includes No Fee, Award Fee, Time and Materials, and Labor Hour contracts.

Table II

DOD AWARDS BY TYPE OF CONTRACT PRICING PROVISION

AS A PERCENTAGE OF TOTAL NUMBER OF AWARDS (FY 1959-1970)[a]

Types of Contract[b]	Percentage by Fiscal Years											
	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
Fixed-Price (Sub-Total)	84.6%	82.8%	83.2%	84.0%	84.6%	85.7%	85.7%	90.4%	91.0%	89.8%	89.3%	88.5%
Firm	72.4	71.8	73.3	74.7	76.1	76.4	79.7	83.0	83.8	82.3	80.6	79.9
Incentive	5.4	4.7	4.3	3.4	3.1	4.6	4.2	3.6	3.7	3.9	5.1	5.3
Other[c]	6.8	6.3	5.6	5.9	5.0	4.7	3.6	3.8	3.5	3.6	3.6	3.3
Cost Reimbursement (Sub-Total)	15.4	17.2	16.8	16.0	15.8	14.3	12.5	9.6	9.0	10.2	10.7	11.5
Incentive	0.5	0.6	0.7	0.9	1.7	2.3	2.4	1.8	1.5	1.8	1.8	1.7
Fixed Fee	10.2	12.1	12.1	11.4	10.4	8.1	6.3	4.6	4.5	5.1	5.3	5.7
Other[d]	4.7	4.5	4.0	3.7	3.7	3.9	3.8	3.2	3.0	3.3	3.6	4.1
Total Percent	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Total Awards (000)	120.7	118.0	122.3	141.5	149.7	146.2	156.8	206.1	229.4	208.0	204.7	177.7

[a] Source: Military Prime Contract Awards, various issues. (Ref 70)
[b] Represents procurement actions of $10,000 or more excluding Intragovernmental.
[c] Includes Redeterminable and Escalation contracts.
[d] Includes No Fee, Award Fee, Time and Materials, and Labor Hour contracts.

Table III

NASA PROCUREMENTS BY CONTRACT PRICING PROVISION

AS A PERCENTAGE OF TOTAL CONTRACT DOLLARS (FY 1961-1970)[a]

Types of Contract[b]	Percentage by Fiscal Years									
	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
Fixed-Price (Sub-Total)	15.5%	14.2%	12.4%	12.3%	14.8%	12.2%	14.0%	11.4%	11.6%	13.4%
Firm	15.3	13.8	11.7	11.5	12.3	10.1	10.9	9.3	9.9	11.4
Incentive	---	.4	.5	.8	2.5	1.9	3.1	2.1	1.7	1.9
Other[c]	.2	---	.2	---	---	.2	---	---	---	.1
Cost Reimbursement (Sub-Total)	84.5%	85.7%	87.6%	87.7%	85.2%	87.8%	86.0%	88.6%	88.4%	86.6%
Incentive	---	1.0	7.2	7.1	12.6	46.8	64.9	49.9	49.1	44.3
Fixed Fee	82.7	82.4	76.5	78.8	71.1	40.3	20.5	37.8	38.6	41.7
Other[d]	1.8	2.3	3.9	1.8	1.5	.7	.6	.9	.7	.6
Total Percent	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Procurement $(millions)	$363	$908	$2113	$3380	$3993	$3951	$3775	$3339	$2909	$2667

[a] Source: NASA, Annual Procurement Report FY 1970, Appendix IV. (Ref 74)
[b] R&D contracts of $10,000 and over, and all other contracts of $25,000 and over.
[c] Includes Redeterminable and Escalation contracts.
[d] Includes No Fee, Cost Sharing, Time and Materials, and Labor Hour contracts.

fee percentage of the total number of DOD contracts also decreased considerably. The percentage of CPIF contracts substantially increased but is still a small fraction of the total number awarded. Fixed-price type contracts increased slowly in percentage. FFP contracts alone accounted for the majority of the total DOD awards during the 1960's.

NASA's shift away from fixed-fee contracts was also significant. The greatest increase in the percentage of contract dollars occurred for CPIF contracts. The FPI dollar percentage also increased noticeably, but remains a small fraction of NASA's total contract dollars. The FFP percentage remained fairly constant.

Purpose of Incentive Contracting

In the competitive market the forces of the marketplace not only set the price for a given quality product, but make survival of a firm dependent on efficient, effective management of resources. Incentive contracting attempts to provide this same motivation for contractors that mainly develop and produce products for the Government. The Government prefers to buy products and services in the competitive market place, preferably through formal advertising. (Ref 65:6) However, the competitive market cannot be used for the bulk of weapon systems acquisition for several reasons. First, the uncertainties and risks in development and production present many risks that private

companies may not be able to bear alone. The risk of a reduction or cancellation of programs as a result of changes in strategic planning or government policy is an example. Second, acquisitions may cover such long periods that immediate response to the occurrence of changes in threat, strategy, policy, and technology is considered essential. Third, the constant advancement of the state-of-the-art, increasing complexities, and requirements for multiple-mission capabilities result in uncertain or unknown weapon system characteristics. Cost estimates are questionable because of these uncertainties. Therefore, during the 1950's the use of cost-plus-fixed-fee contracts was predominant except in follow-on-production buys and ship construction. (Ref 36:52-55) Cost-plus-fixed-fee contracts offer no incentives to industry for cost control or efficient use of resources. The contractor receives the previously negotiated fixed-fee regardless of the flexible cost outcome.

Firm-fixed-price contracts more closely resemble the contractual relationship in the free-enterprise market. FFP contracts theoretically provide maximum cost reduction incentives since profit is the difference between the fixed price and contract costs. FFP and CPFF contracts are the two extremes on the continuum of contract types. Incentive contracts are an attempt to provide a complete continuum of incentives for various levels of risk and uncertainty associated with any particular project in the defense and

NASA acquisition process.

Proposed changes in armed forces procurement policies and practices were one of the most important issues during the Second Session of the 86th Congress in 1959 - 1960. Congress emphasized the importance of selecting the correct contract type for a particular procurement. (Ref 32:15) The Department of Defense in 1962 revised the Armed Services Procurement Regulations to encourage the use of incentive contracts. The CPFF contract, the most frequently used cost reimburseable type, did not provide adequate incentive for contractors to control cost. These revisions established CPIF contracts as preferable for use in the research and development phase of weapon system programs and recommended the use of FFP or FPI contracts for production phases. The use of CPFF contracts was limited to situations involving considerable uncertainty in which incentive-type contracts would be impractical. (Ref 13:64)

Cost reduction was the original justification for increased use of contractual incentives by the Defense Department. Other possible benefits were recognized and were added to the incentive arrangements. The Logistics Management Institute (LMI) conducted a survey in 1968 to determine the motives for the use of incentive contracts by government contracting personnel. LMI summarized the responses as follows:

1. Incentives motivate efficient contract management and achievement of a high performance product.

2. Incentives enable the Government to reward contractors on the basis of demonstrated management ability and product performance.
3. Incentives assign to the contractor a larger portion of contract risk than would be borne with a CPFF contract.
4. Incentives provide explicit communication of the Government's contracting objectives.

LMI's opinion is that statements 2 and 3 are motivato to achieve 1. Statement 4 is a benefit of, rather than a justification for, incentive contracting. Therefore, the four statements reduce to the first. The purpose of incentive arrangements in contracts is to motivate efficient contractor management and the achievement of a high performance product. (Ref 35:3-6)

The Profit Controversy

The subject of profit has met with controversy throughout the history of defense procurement. CPFF and cost-plus-percentage-of-cost (CPPC) contracts were the predominant procurement methods used in World War I. CPPC contracts were responsible for much of the inefficiency and profiteering of that war and were forbidden after May 1918. Following World War I, debate was focused largely on the problem of "profiteering". War millionaires were accused of engineering the war for financial gains. Many argued that future wars could be avoided if a means was devised to remove the profit from war products. One of the objectives of the War Policies Commission, established by Congress in 1930, was to study

methods to limit war profits. Approximately 200 bills and resolutions dealing with this objective were considered by Congress between the two World Wars. (Ref 48:38-40)

Congress authorized the CPFF contract early in World War II with a maximum fee of seven per cent of the estimated cost. CPFF contracts were an essential and useful part of the procurement program during this war but became the most controversial method used. Although Congress authorized the use of the CPFF contract, Congress and the public have had serious apprehensions about its use. The military departments have attempted to limit CPFF use while insisting before Congress that its use should be continued. (Ref 48: 124, 129)

Frederic Scherer stated:

> The CPFF contract does not provide a correlation between profit and cost, and therefore, has no contractual incentive for efficiency. There is a conflict between minimizing the risk of windfall profits and maximizing the incentive for efficiency. Incentive contracts were developed as a compromise between these two conflicting goals. (Ref 58:134)

During the 1959 hearings on the extension of the renegotiation law (discussed in Appendix B), DOD and the aerospace industry recommended an amendment to exempt incentive earnings under incentive type contracts from the regular renegotiation process. Rep. Carl Vinson (D. Ga.), Chairman of the House Armed Services Committee, charged that the objective of industry was excess profits, and succeeded in having the Renegotiation Act extended until 1962 without significant change. As a by-product of

these hearings, a bill was drafted by the General Accounting Office (GAO) and sponsored by Vinson in 1960. This proposal stated:

> no contract negotiated... shall contain a profit formula or price redetermination provision that would allow the contractor increased fees or profits for cost reductions or target cost underruns resulting from causes other than those which the contractor can clearly and completely demonstrate are due to skill, efficiency, or ingenuity in the performance of such contract. (Ref 25:34)

The joint opinion of Vinson, the GAO and the Renegotiation Board was that the contractor "savings" under incentive-type contracts for the most part have been due to cost over-estimates when the target price was established. DOD strongly opposed this legislation at hearings before the House Armed Services Committee in May 1960. Perkin McGuire, Assistant Secretary of Defense for Installations and Logistics, told the committee:

> This proposal would force DOD to enter into more and more CPFF contracts which are frequently the most costly and inefficient types. All possible cost reductions should be encouraged, rather than limiting the sharing of cost reductions only to those of which such proof is possible. A lower product cost is achieved when all potential savings are made and the established share of these savings reverts to the Government than when any parts of such savings are discouraged for the lack of not being demonstrably earned. (Ref 25:34)

Additional controversy started in January 1962 over the U.S. Tax Court's first decision in a major renegotiation case. Boeing was ordered to refund $13 million in excess profits for the year 1952. Boeing officials requested a court decision with profits based on sales. The Renegotiation Board argued that profits should be based on

the company's net worth, and attempted to recover $20 million. Judge Craydon G. Withey said that Boeing's books did not account for the value of design engineering and manufacturing technology. He estimated these intangibles to be at least the value of all Boeing's book assets combined. Judge Withey lumped these assets together, called the sum "whole net worth", and reduced the claim to $13 million.

An official of the Aerospace Industries Association said that the Boeing case was a good illustration of the arbitrariness of the renegotiation process. First the regional board decided that Boeing had no excess profits for 1952. The main board then claimed excess profits of $10 million. During the Tax Court trial the board claimed $20 million. Finally Judge Withey ruled excess profits of $13 million. (Ref 27:32-33)

Secretary McNamara, in DOD's continued effort to exempt incentive earnings from renegotiation, told the House Appropriations Subcommittee on the Armed Services:

> There are some very serious problems on renegotiation brought about by the decision in the Boeing case. Without modification, this case would undermine the entire program to place increasing emphasis upon cost reduction by incentives and penalties to the contractors, in relation to the extent that objectives are or are not met, financially and otherwise. (Ref 30:21)

McNamara indicated that there would be no restraint in levying penalties when warranted under the incentive system and said, "this is a profit-and-loss-economy, not just a profit economy." This statement clashed with several

Congressmer. One Congressman stated:

> McNamara presumes to tell the federal judiciary what it should do. He presumes to tell the Renegotiation Board, which functions under a law laid down by Congress, what it should do. (Ref 30:21)

Judge John E. Mulroney, U.S. Tax Court Oct. 25, 1962, ordered North American Aviation to refund $16.5 million excess profits on government contracts for 1953 and 1954. Mulroney praised the superior work of North American, but calculated the profit refund by the method of the Boeing case. The Tax Courts essentially ruled that superior work does not justify superior profits. (Ref 77:117)

An April 26, 1968 quote by the Associated Press states:

> Vice Adm. Hyman G. Rickover has charged again in closed hearings before a House Committee that many corporations doing defense contract work are making excess profits, and DOD is both unwilling and unable to stop this practice. Rickover also charged that profits reported by defense contractors are often substantially lower than the profits actually made, and that excessive profits are hidden by bookkeeping procedures. Rickover also stated that in the period 1964 - 1967, profits on defense contracts rose by 25 per cent over the period 1959 - 1963. There is increasing difficulty in getting industry to accept and perform orders for military equipment in a timely and economical manner. (Ref 78:65-66)

Secretary of Defense Clark Clifford, in a 1968 letter to the House and Senate Appropriations and Armed Services Committees, challenged allegations of excess profits:

> The average negotiated 'going-in' profit has increased from 7.7% on estimated cost, to 9.4% since January 1964 - a 22% increase. Despite this apparent improvement in profit opportunities, contracts show no improvement in realized profits, but remain at the 1959 - 1968 level. Industry cannot be expected to accept greater risks, and to provide an even larger share of the financial resources...without a valid opportunity to obtain profit results

commensurate with the lower cost to the Government. (Ref 7:11-18)

Senator William Proxmire (D-Wisc.) and others have been skeptical about the adequacy of the defense profit figures calculated by the Renegotiation Board and by the Logistics Management Institute, a non-profit organization subsidized by DOD. The most recent LMI study, "Defense Industry Profit Review," covered the years 1958 - 1968. (Refs 39 and 40) LMI selected a sample of 258 defense companies within six durable-goods categories and from 3500 manufacturing companies listed with the Federal Trade Commission and the Securities and Exchange Commission (FTC-SEC). This sample was divided into two groups:

1. 41 Defense-oriented companies which each had more than $25 million annual defense sales and more than 10 per cent of their total sales to DOD.
2. 217 Commercially-oriented companies which each had less than $25 million annual defense sales or less than 10 per cent of total sales to DOD.

The profitabilities of these two groups were compared with that of the original FTC-SEC group with these companies excluded. This comparison of the "after tax" per cent profit on total capital investment (TCI) showed a decrease from 10 to 7 per cent for the defense-oriented group while the commercially-oriented group increased slightly and the FTC-SEC group increased considerably. The defense-oriented group initially had the highest profit of TCI of the three groups, but had the lowest at the end of this period. (Ref 40)

Admiral Rickover stated to the Senate Banking panel: "No one knows how much profit industry makes on defense contracts - not the DOD, the GAO, or the Renegotiation Board." (Ref 57:27) The Armed Forces Journal stated:

> Rickover gave no explaination of why publicly-owned defense-contractors would purposely keep books that would show overall profits on sales or stock-holders' return on investment, as poorly as LMI reported, and which would show up so poorly before the same financial community on which the corporations depend for successful stock underwritings, loans, and the trading of stock already issued.
>
> In a capitalistic society, it is ironic that the quest for profit is considered an honorable motivation for every industry except one: the defense contractor, for without these products neither the country, nor the economy, nor some non-defense industries could long survive. Charges of "excess profits" get front page headlines, when evidence exists which clearly proves that such allegations are more fantasy than fact. These allegations come from samples which are both small and statistically irrelevant--and from men who know it, and seldom comment on the other side when the data does become available. Among these men are Admiral Rickover, Senator Proxmire and former Assistant Secretary of the Treasurer Murray Weidenbaum, once chief economist for the Boeing Company.
>
> Department of Defense officials, who should be most concerned about the health of the defense industry, have little perception of what this assult on the military-industrial complex has really cost. Too few seem to realize where the industry stands today, overall, compared with other sectors of the economy, or what this comparison implies. The comparison implies that the assault on the military-industrial complex from Congress and the daily press has undermined the basic economic strength of the defense industry. (Ref 57:24-25, 27)

Objective of the Research

Numerous research studies of procurement and financial data have been conducted to determine if the Government's policy shift to incentive contracting has been eff-

ective in motivating the defense and space industry toward improved managerial performance. It was DOD's belief that this motivation would reduce the Government's overall costs in weapon systems acquisition and improve the profits of the individual contractors. Many of the earlier studies analyzed groups of individual contract outcomes and determined profit rates and trends by contract types. This type of research, sometimes called a microscopic analysis, was conducted by Frederick Moore (Ref 49) and Irving Fisher (Refs 12 and 14) of Rand Corporation, Frederic Scherer (Ref 58), Merton Peck and Frederic Scherer (Ref 52) of Harvard University, and several others.

In contrast to individual contract analysis is the macroscopic approach of the effects of incentives on the defense industry as a whole. The annual financial data of representative samples of defense and NASA contractors are determined individually and by group averages. Annual averages of this group's financial ratios are compared with those of a group of similar industrial firms that have only commercial sales.

LMI conducted a series of "Defense Industry Profit Reviews" which were designed to gain a better understanding of realized or "coming out" profit in general, the macroscopic analysis, and profit on price competitive contracts in particular. LMI's most recent study was previously discussed. The earlier study covered the period 1958 - 1966. (Refs 37 and 38)

Defense industry sales and profit data for the earlier LMI study were solicited voluntarily from approximately 65 companies. These companies were placed in the following three categories according to volume of defense sales:

High volume	-	$200 million or more
Medium volume	-	$25 to $200 million
Low volume	-	$1 to $25 million

The average profit rates from each of these three categories were compared with consolidated data from six durable goods categories of non-defense industry from the FTC-SEC, Quarterly Financial Report for Manufacturing Companies. The products of these FTC-SEC firms most closely corresponded with those purchased by the DOD. Comparisons were based on the following ratios: profit earned on total capital investment (Profit/TCI), profit earned on equity capital investment (Profit/ECI), TCI turnover (Sales/TCI), ECI turnover (Sales/ECI), and profit on sales (Profit/Sales). The ratios were generally shown as "before" federal income tax.

The Armed Forces Appropriation Authorization Act for fiscal year 1970 directed the GAO to study profits earned on negotiated contracts and subcontracts entered into by the DOD, NASA, Coast Guard, and Atomic Energy Commission. The GAO, Defense Industry Profit Study (Ref 72), covering the years 1966 - 1969, divided 74 large DOD contractors into categories, similar to

those used by LMI, as follows:

1. High-volume defense contractors
   (a) At least 10 per cent of total company business on defense sales.
   (b) Over $200 million in average annual defense sales.
2. Medium-volume defense contractors
   (a) At least 10 per cent of total company business in defense sales.
   (b) Average annual defense sales of less than $200 million.
3. Commercially oriented defense contractors
   (a) Less than 10 per cent of total company business in defense sales.
   (b) Substantial defense business.

GAO compared the profitability of the three categories with similar ratios used by LMI.

Dr. David L. Belden conducted a study which encompassed both the microscopic and macroscopic analyses of defense industry profits. This study was published in 1969 as Stanford University Technical Report No. 69-2. (Ref 3) Belden's research covered the years 1956 - 1967. The macroscopic analysis was based on data obtained from the Fortune Directory of the 500 Largest Industrial Corporations and the lists of the top 100 contractors by contract value for both DOD and NASA. The Fortune 500 corporations were categorized annually in three groups according to each firm's government sales as a percentage of total sales revenues. The profitabilities of the groups were compared by ratios similar to those previously described.

The objective of this research is an extension of Belden's basic macroscopic research and re-examines, updates, and analyzes the results of the change in the procurement policies. The specific objective is to de-

termine if the shift in the Government procurement policy from cost-plus-fixed-fee to firm-fixed-price and incentive contracts has been effective in motivating DOD and NASA contractors to be more efficient in the use of capital and labor resources. This also will determine whether Belden's conclusions are still valid when current years are included in the data base. The current data base available, 1956 - 1969, provides a longer time period for an adjustment to the procurement policy changes to have become visible. More incentive type contracts have also been completed in this longer time frame.

Assumptions

This research is based on the analysis of financial data taken from various issues of the Fortune Directory of the 500 Largest Industrial Corporations (Ref 61), the Department of Defense listing of 100 Companies and their Subsidiary Corporations Listed According to Net Value of Military Prime Contract Awards (Ref 69), and the National Aeronautics and Space Administration's Annual Procurement Report. (Ref 73) The following assumptions are used:

1. The corporate financial data listed in the three sources mentioned are fairly presented, are in conformity with generally accepted accounting principles, and are applied on a consistent basis. (Ref 1:274)

2. The effectiveness of incentive contracting will be reflected in contractor profitability from past to pre-

sent through the period of procurement policy change.

Hypothesis

The following hypothesis pertaining to the problem is established:

Incentive type contracts motivate defense and NASA contractors toward increased managerial efficiency in the use of capital and labor resources. The group of industrial firms for which DOD and NASA sales account for more than 50 per cent of each firm's total sales revenues exhibit a relative increase in the various financial profitability and productivity indicators. This increase is relative to other similarly large industrial firms not having government contracts.

Summary

The profits of government contractors and the rising costs of products is a continuous and controversial subject. The Office of Secretary of Defense in the early 1960's established objectives to shift defense procurement toward more competition and to shift contract use from fixed-fee toward firm-fixed-price and incentive contracts. These objectives have since been emphasized by both DOD and NASA and resulted in a significant increase in the use of incentive contracts.

The Government believed that the motivation from fixed-price and incentive contracts would increase

contractors' efficiency in the use of total resources and thereby increase productivity and profits. The negotiated contract price would then be controlled under firm-fixed-price contracts, or the final cost could be reduced by the provisions of incentive contracts. The Government and contractors benefit financially from both contract types.

This research analyzes the annual profitability and productivity results of large industrial firms for which DOD and NASA sales account for more than 50 per cent of each firm's total sales revenues. The data from this group of government-oriented firms are compared with data from a group of similarly large industrial firms with no government sales. The research objective is to determine whether the financial status of defense and NASA firms has improved at a rate that exceeds that of the comparison group during the "incentive environment."

II. Methodology

Since this research is a continuation of Dr. Belden's previously cited basic research, the same methodology is used in order to maintain his base for the extended macroscopic analysis and evaluation of previous and current data.

DOD and NASA's 100 largest contractors receive the greatest share of the Government's total annual procurement dollars. The top 100 DOD contractors, for example, continuously exceed 65 per cent of DOD's annual procurement dollars while the top twenty-five DOD firms receive nearly one-half of the total. Detailed data is presented in Table IV of the percentage distribution of DOD contract dollars for each of the top four groups of twenty-five firms. Table V presents NASA's percentage distribution of prime and subcontract dollars to small and large firms. The majority of this combined group of government contractors is also among the 500 largest industrial corporations.

The question of whether the shift toward increased use of firm-fixed-price and incentive contracts has induced government contractors to be more efficient in the use of resources is logically answered by the financial performance of this group of firms. The results of the intensified

Table IV

PERCENTAGE OF DOD PROCUREMENT DOLLARS[a]

AWARDED TO CONTRACTORS RANKED BY DOLLAR SHARE (FY 1959-1970)

No. of Firms	Fiscal Year											
	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
1- 25	54.6%	53.5%	54.8%	50.8%	51.9%	52.9%	48.2%	43.0%	44.5%	45.6%	44.8%	46.0%
26- 50	10.7	11.3	11.0	12.6	13.7	12.9	13.0	12.1	11.6	11.5	12.1	13.3
51- 75	5.5	5.4	5.5	6.0	5.5	5.1	5.2	5.4	6.1	6.6	7.3	6.6
76-100	3.0	3.2	2.9	2.9	2.8	2.5	2.5	3.3	3.3	3.7	4.0	3.8
1-100	73.8	73.4	74.2	72.3	73.9	73.4	68.9	63.8	65.5	67.4	68.2	69.7
All others	26.2	26.6	25.8	27.7	26.1	26.6	31.1	36.2	34.5	32.6	31.8	30.3

[a]All procurement actions of $10,000 or more.

Source: 100 Companies and Their Subsidiary Corporations Listed According to Net Value of Military Prime Contract Awards, Directorate of Information Operations, Office of the Secretary of Defense. (Ref 69)

Table V

NASA PRIME CONTRACT AND SUBCONTRACT AWARDS (Fiscal Years 1961-1970)

	Fiscal Years									
	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
No. of Prime Contractors Reporting Data	12	28	33	43	57	71	85	85	86	83
	Subcontract Awards									
Subcontract Awards ($ millions)	$28	$245	$580	$1283	$1302	$1233	$903	$815	$619	$406
Subcontract $ Percentage										
To Small Firms	47%	39%	40%	38%	32%	37%	37%	32%	27%	27%
To Large Firms	53%	61%	60%	62%	68%	63%	63%	68%	73%	73%
	Total Prime and Subcontract Awards									
Total Contract Awards ($ millions)	$423	$1031	$2262	$3521	$4141	$4088	$3864	$3447	$3022	$2759
Sub-Total $ Percentage To Small Firms	18%	21%	19%	21%	17%	17%	14%	13%	11%	10%
Prime Contracts	15	12	8	7	7	6	6	6	5	6
Subcontracts	3	9	11	14	10	11	8	7	6	4
Sub-Total $ Percentage To Large Firms	82%	79%	81%	79%	83%	83%	86%	87%	89%	90%
Prime Contracts	78	65	66	56	62	64	71	71	74	79
Subcontracts	4	14	15	23	21	19	15	16	15	11

Source: NASA, Annual Procurement Report FY 1970, Appendix VIII. (Ref 74)

"incentive environment" are evaluated by a macroscopic comparison of the financial performance of three groups of large industrial corporations having various amounts of DOD and NASA sales. This methodology does not attempt to distinguish between the effects of the increased use of incentive contracts on profits by the individual contract types or by individual contract outcomes.

Sources of Financial Data

The financial data used was obtained from the three sources mentioned previously: Fortune; the Department of Defense; and the National Aeronautics and Space Administration. The annual Fortune Directory lists the 500 largest industrial corporations by annual net sales. Net sales include service and rental revenues. Each company listed must have derived more than 50 per cent of these revenues from manufacturing and/or mining. (Ref 61) DOD and NASA each list the top 100 contractors according to net dollar value of prime contract awards received in a given fiscal year.

Division of the Fortune 500

The Fortune 500 firms for each of the years 1956 through 1969 are divided into three mutually exclusive groups according to the percentage of total sales revenues which result from DOD and/or NASA sales for each firm. A few of the 500 firms are omitted in 1956 - 1962 because of incomplete data. The group divisions are:

Zero (O) - Firms not in the DOD and NASA listings.

Low (L) - Firms with DOD and NASA sales amounting to more than zero but not more than 50 per cent of total sales revenues.

High (H) - Firms with DOD and NASA sales amounting to more than 50 per cent of total sales revenues.

The top 25 DOD contractors receive nearly one-half of DOD's annual procurement dollars. A similarly large share of NASA's annual procurement dollars is also received by a small number of firms. In most cases, Group H includes most of these large dollar value contractors. Specific breakdown of the number of firms in each group is discussed in the next chapter. The effects that the increased use of incentive contracts have upon Group H can logically be expected to affect the majority of other equally large government contractors in the same general way.

However, as Dr. Belden states:

> The government sales percentage computed for each firm is not a precise figure, but instead is a conservative estimate used to group the firms. This figure is an estimate because only direct government sales and contracts of $10,000 or more are included. (Ref 3:51)

Part of the DOD and NASA procurement dollars are not included in this research because of firms not listed in the Fortune Directories. For example, twenty firms from the DOD list are not included in the 1969 Fortune Directory because either their individual total sales revenues are too small or they did not qualify as industrial firms. However, these firms have a combined sum of less than 6 per cent of the total DOD procurement dollars. An equally

small percentage of NASA's total annual procurement dollars is also excluded for the same set of reasons.

Financial Ratios

Various financial ratios and profitability indicators are computed for each firm for each year. The means and standard deviations for each ratio are computed for each of the three groups of firms. The ratios used are the returns on sales, assets, and equity capital, total assets turnover, equity capital turnover, and sales dollars per employee. The profit ratios or returns are shown as "after federal income tax" since Fortune quotes corporate profits after taxes. The group means and one standard deviation about the mean are graphed for each ratio.

Trend Analysis

The hypothesis is evaluated by trend analysis and by comparing the graphs of Group H with those of Group O for the years 1956 - 1969. "Prior period" refers to the years before the emphasis on incentive contracting in 1962. The "incentive environment" period includes the years 1962 - 1969.

An analysis of the Group H mean, for each financial ratio or indicator, is made to determine if the general trend has changed between the "incentive environment" period and the "prior period." A more thorough analysis is made on a year to year basis. The numerical difference

between the means of Group H and Group O for each year is compared with that of the previous year. The following mechanism is established to standardize this analysis and thus reduce the difficulty of assessing trends:

1. "Opposing steps" are financial results opposite of the desired outcomes from the "incentive environment." An "opposing step" is defined as any annual movement of the two group means that gives Group H a "less favorable" financial position than in the previous year, relative to Group O. An "opposing step" occurs in any of the following conditions:

   a. The Group H mean is above Group O and the difference between the means decreases.

   b. The Group H mean is below Group O and the difference between the means increases.

   c. The two graphs intersect and the mean of Group H is the smaller numerical value.

2. "Incentive steps" are favorable financial results of the "incentive environment." An "incentive step" is defined as any movement of the two group means that gives Group H a "more favorable" financial position than in the previous year, relative to Group O. An "incentive step" occurs in any of the following conditions:

   a. The Group H mean is above Group O and the difference between the means increases.

   b. The Group H mean is below Group O and the difference between the means decreases.

   c. The two graphs intersect and the mean of Group H is the larger numerical value.

The absolute value of the magnitude of the difference

in the annual difference between the two group means for any two successive years is called the "step magnitude". For the exceptional cases of the intersecting graphs, the "step magnitude" is the sum of the annual differences between the two group means for the two years.

The existence of "opposing steps" and increasing growth of the "step magnitudes" would tend to disprove the stated hypothesis. "Step magnitudes" are of greater importance in assessing the "more favorable" effects than the "less favorable" effects of the "incentive environment." The justification for accepting the stated hypothesis tends to be strengthened as the "step magnitudes" grow larger over a period of several years. "Step magnitudes" are therefore subdivided as "significant" and "insignificant" and are differentiated by numerical limits or "step limits" for assessing the specific graphs of the profitability and productivity indicators. "Insignificant step magnitudes" are noticeable on the graphs but are not analyzed in detail. Common to all graphs, for example, is the small group size of Group H which produces a less stable mean than the mean of the larger Group O. "Insignificant step magnitudes" contribute little in proving or disproving the hypothesis.

The Returns on Sales, Equity Capital, and Assets are graphed with net profit as a percentage of the respective dollar value of the indicator. The differentiable step limits expressed in per cent for these graphs are:

"Insignificant Step Magnitude" - less than 0.25

"Significant Step Magnitude" - 0.25 and greater

Equity Capital Turnover and Total Assets Turnover are ratios of sales dollars to the respective dollar value of capital and assets. The differentiable step limits are:

"Insignificant Step Magnitude" - less than 0.1

"Significant Step Magnitude" - 0.1 and greater

The graph of Sales Dollars per Employee has differentiable step limits defined as follows:

"Insignificant Step Magnitude" - less than $500

"Significant Step Magnitude" - $500 and greater

The differential step limits used for Equity Capital Turnover, Total Assets Turnover, and Sales Dollars per Employee are smaller than those used for the return indices. The relatively smooth trends of the former indices permits the use of tighter step limits. The use of large step limits for the return indices is necessitated by the amount of fluctuation in the trends of these indices.

Summary

This research is conducted under the basic methodology developed by Dr. Belden in a previous study. This methodology is a mechanism for a macroscopic analysis of the annual financial performance of the 500 largest industrial firms listed by total sales revenues in Fortune. The largest part of the total annual DOD and NASA procurement dollars flows into contracts with these large industrial corporations. The average profits and other

financial performance indicators of selected groups of firms are therefore examined to determine if the incentive shift has improved the financial status of the group of government-oriented contractors relative to a group of firms with no government business. The methodology does not provide an evaluation of industrial contract types or contract outcomes.

Fortune's Directories are divided by year into three groups by each firm's government sales revenues as a percentage of total sales revenues. The group divisions are: Group O - zero per cent; Group L - more than zero but not more than 50 per cent; and Group H - more than 50 per cent.

Various annual "after tax" financial ratios and profitability indicators are computed for each firm. The group averages and variances of the three groups are computed and plotted for the period 1956 - 1969. The plotted data are evaluated by a yearly analysis and trend comparison. The primary purpose of this evaluation is to determine what effects the shift to a greater percentage of fixed-price and incentive contracts had on the performance of Group H, relative to the performance of the control Group O. The performance of Group L is also of interest but is not the focal point of this research.

III. Data Analysis

Introduction

This chapter includes a brief discussion of several general financial events that affected corporate profitabilities during the period covered by this research. A detailed evaluation of data using the described methodology is explained and conclusions concerning the hypothesis are stated.

Dr. Belden's previous conclusions tended to discount the 1967 data. This final year of his data had overall sales and profit declines, and the data produced returns on sales, net worth, and assets, which decreased for Group O but increased for Group H. Since 1967 was the final year of this previous research, definite and strong conclusions as to the importance of this year's contribution to a trend, or a changing trend were not made. The additional data of 1968 and 1969 add insight to the importance of the 1967 data.

General Analysis

The total number of Fortune 500 companies used each year and the number of companies in each of the three mutually exclusive groups are shown in Table VI. The

Table VI

NUMBER OF COMPANIES IN GROUPS O, L, AND H

(1956-1969)

Year	Group O	Group L	Group H	Total
1956	424	49	18	491
1957	420	57	14	491
1958	426	50	20	496
1959	430	52	16	498
1960	429	52	17	498
1961	428	46	23	497
1962	429	50	20	499
1963	433	50	17	500
1964	431	53	16	500
1965	428	50	22	500
1966	431	51	18	500
1967	432	54	14	500
1968	421	68	11	500
1969	418	79	3	500
1969[a]	418	79	2[a]	499[a]

[a]Figures computed with Lockheed's financial data (loss) excluded.

number of companies in Group O, with zero government sales, has remained nearly constant throughout the entire period. Group H, companies with more than one-half of total sales revenues from DOD and NASA, is decreasing in number. Group L is absorbing most of the firms that Group H loses. A severe drop occurred in the number of Group H firms in 1969. The three firms remaining increased the group's previous average of each firm's government sales to total sales revenues as is shown in Table VII. There are no companies in 1969 having government sales between 50 and 80 per cent. Three companies in Group L have government sales of 40 to 50 per cent of total sales revenues and one-half of the group have less than 10 per cent. This trend indicates that large government contractors are diversifying by adding product lines for non-defense markets, by merging to form conglomerates, and by acquiring subsidiaries. Diversification increases the parent company's or the conglomerate's total sales revenues, but the DOD and NASA per cent of the total sales revenues tends to decrease. This decrease moves the firms toward or into Group L.

The Armed Forces Journal conducted an analysis concerning the decreasing economic strength of the defense industry during the 1960's. The following conclusions were expressed in the Journal article:

> Defense contractors listed among the top 100 companies in Forbes' "profitability rankings" declined from 27 in 1965 to 12 in 1970. In 1967, 27 defense contractors ranked among the top 100

Table VII

ANNUAL AVERAGE DOD AND NASA SALES AS A PERCENTAGE OF TOTAL SALES FOR GROUPS L AND H (1956-1969)

Year	Group L	Group H
1956	15.6%	75.2%
1957	17.1	86.0
1958	18.7	80.6
1959	18.8	75.7
1960	18.8	76.6
1961	18.0	75.4
1962	16.9	72.7
1963	15.5	74.2
1964	15.5	77.2
1965	14.8	76.6
1966	17.1	78.3
1967	20.4	72.4
1968	18.0	66.6
1969	14.8	84.0
1969[a]	14.8	80.5[a]

[a]Figures computed with Lockheed's financial data (loss) excluded.

companies in Forbes' "growth in earnings," but this number was reduced to 11 in 1970. The 1970 total stock market value of the top fifty publicly-owned defence contractors decreased 12 per cent from the 1966 level. The market value of the top fifty non-defense companies increased 40 per cent and all shares listed on the New York Stock Exchange increased 25 per cent in the same period. "War profiteering" doesn't pay very well. (Ref 57:25)

Net Profit

The average net profit for each group is plotted in Figure 1 and Figure 2 from data contained in Table VIII. Figure 1 presents a comparison of the net profit trends in dollars. There is an extreme difference between the profit values of the three groups. The 1956 values of each group are set at 100 per cent and the profits of succeeding years are plotted as a percentage of this base as in Figure 2. Group L has the highest profits of the three groups and the greatest overall increase in profits throughout the period. Group L consistently includes more than three-fourths of the 15 highest profit earning companies in the Fortune 500, and in every year includes the top five. The remainder of these companies are always in Group O.

Group O shows a steady, stable profit growth while Groups H and L are more erratic. This is partially explained by the effect which the group size has on the mean. Group O has a fairly constant size of around 425, while Group L was one-sixth that of Group O and Group H was considerably smaller than Group L.

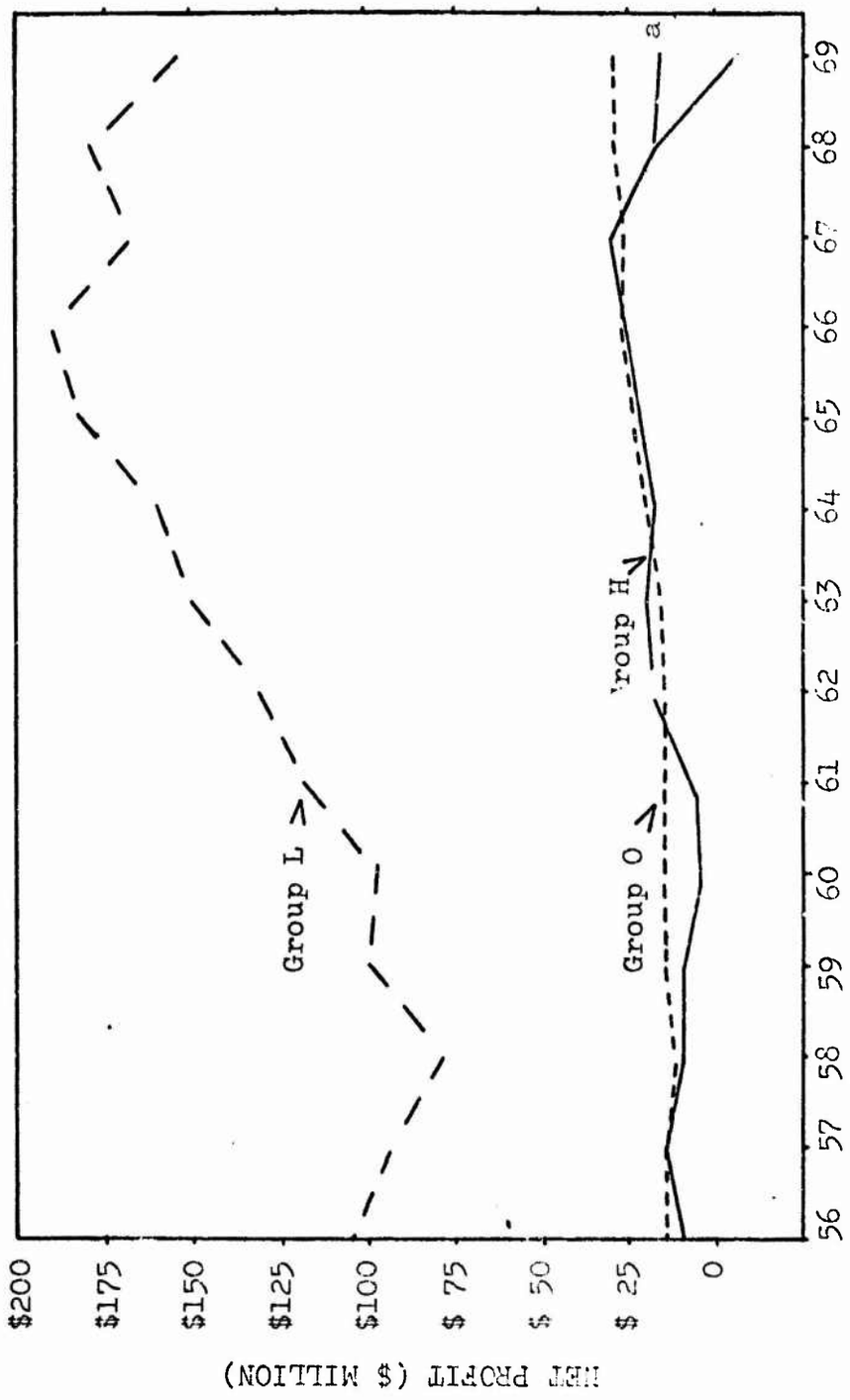

Figure 1. Net Profit Trends for Groups O, L, and H

Source: Data from Table VIII.

[illegible] Lockheed data excluded in 1969.

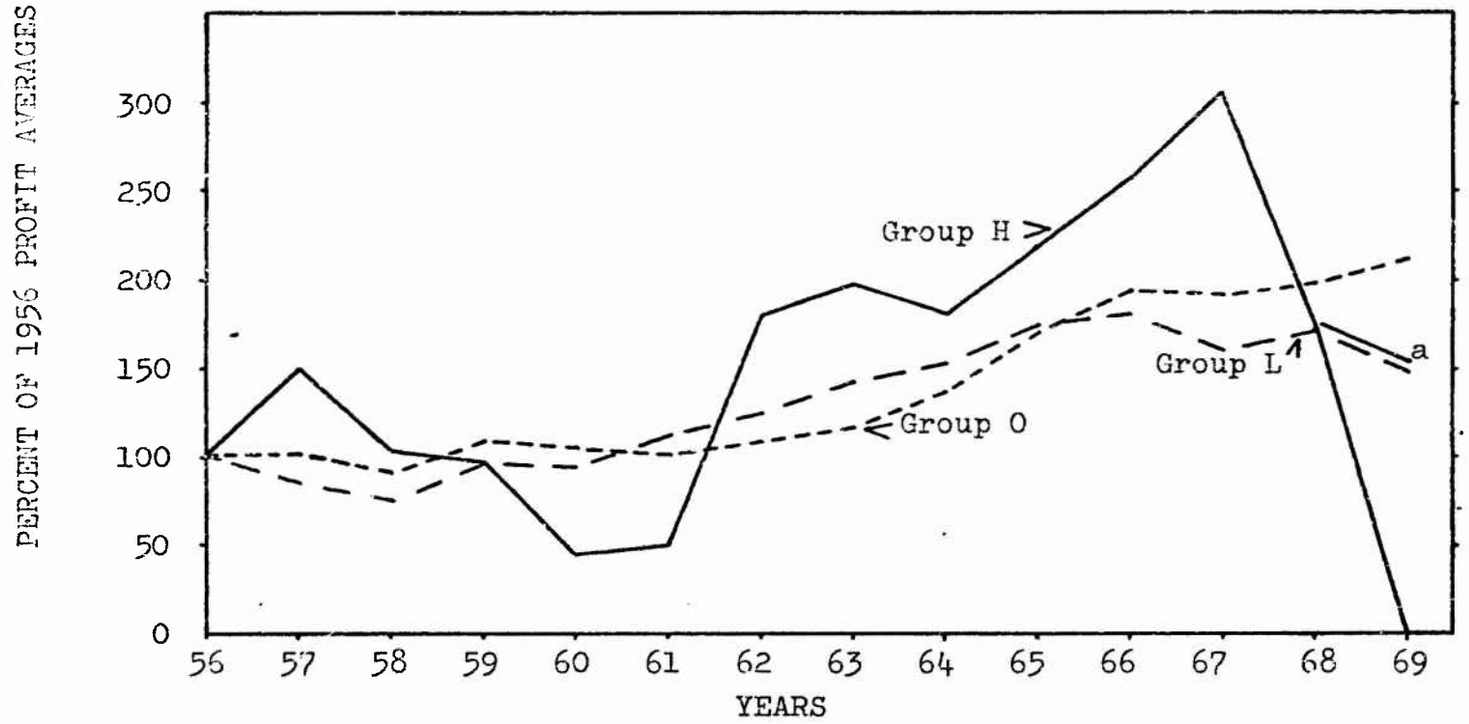

Figure 2. Net Profit Trends for Groups O, L, and H (1956=100%).

Source: Data from Table VIII.

[a]With Lockheed Data excluded in 1969.

Table VIII

ANNUAL AVERAGE NET PROFIT FOR GROUPS O. L, AND H

(1956-1969)

Average Profits ($millions) and Per Cent of 1956 Values						
Year	Group O		Group L		Group H	
1956	$14.3	100 %	$105.0	100 %	$10.1	100 %
1957	14.4	100.6	93.7	89.2	15.0	148.5
1958	12.8	89.5	78.1	74.4	10.3	101.9
1959	15.5	108.4	99.2	94.5	9.7	96.0
1960	14.9	104.2	98.4	93.7	4.5	44.6
1961	14.2	99.3	117.9	112.3	5.1	50.5
1962	15.4	107.7	130.6	124.4	18.1	179.2
1963	16.5	115.4	150.5	143.3	19.9	197.0
1964	19.7	137.8	160.0	152.4	18.2	180.2
1965	24.3	169.9	182.6	173.9	21.9	216.8
1966	27.6	193.0	190.5	181.4	25.7	254.5
1967	27.5	192.3	168.2	160.2	30.8	304.9
1968	28.1	196.5	179.2	170.7	17.7	175.3
1969	29.9	209.1	154.2	146.8	- .5	0.0
1969[a]	29.9	209.1	154.2	146.8	15.5[a]	153.5[a]

[a]Figures computed with Lockheed's financial data (loss) excluded.

The number of companies in each group with net losses also affects the group means. The stability of Group O is more evident when the net losses each year for the three groups are examined as a percentage of the group size. Table IX illustrates, for example, that in 1960, the nineteen companies with losses represent 4 per cent of the firms in Group O while in the same year three companies with deficits represents nearly 18 per cent of the H Group. The years with the greatest number of losses for all groups correspond to the dips and level segments of the net profit graphs. The instability of Group H was very evident in both the early and late 1960's. The low drop in the profit mean for Group H in 1960 is caused by Lockheed's loss of $43 million and a $19 million loss by Douglas. Lockheed's loss was the result of modifications to the Electra and heavy development costs on the Jetstar. (Ref 62:167) The Douglas deficit also resulted from commercial products. (Ref 3:53) In 1961 General Dynamics lost $143 million on the Convair jet failure. (Ref 63:171) Fairchild Hiller's $2.5 million deficit in 1968, caused by the cancellation of several commercial programs, drastically reduces the mean of Group H, as does Lockheed's $33 million loss in 1969.

The average net profit of Group O fell only $.5 million amidst the general sinking profits of 1967. Neither Group H or L includes companies with deficits in 1967, but the L Group mean fell considerably. The Fortune Directory reported 237 companies with earning declines. Thirteen

Table IX

NUMBER OF NET LOSSES FOR GROUPS O, L, AND H

AS A PERCENTAGE OF GROUP SIZE

Year	Group O		Group L		Group H	
	No. of Losses	Per Cent	No. of Losses	Per Cent	No. of Losses	Per Cent
1956	8	1.9%	0	0%	0	0%
1957	9	2.1	1	1.7	0	0
1958	15	3.5	2	4.0	0	0
1959	7	1.6	2	3.8	0	0
1960	19	4.4	2	3.8	3	17.6
1961	21	4.9	0	0	2	8.7
1962	12	2.8	0	0	0	0
1963	12	2.8	0	0	0	0
1964	5	1.2	1	1.9	1	6.3
1965	8	1.9	0	0	1	4.5
1966	5	1.2	0	0	1	5.6
1967	9	2.0	0	0	0	0
1968	11	2.6	1	1.5	1	9.1
1969	8	1.9	2	2.5	1	33.3

industry groupings showed increases in their median profit, while none had decreases. Nineteen companies among the top fifty industrials reported lower earnings and of these McDonnell Douglas and Ford, of the L Group, had the lowest earnings. (Ref 46:187)

Group L includes two firms with deficits in 1969. Sanders Associates had a deficit of nearly $2 million and Ling-Temco-Vought lost $38 million. Nearly half LTV's assets were tied up in an anti-trust suit over the acquisition of Jones and Laughlin Steel Corporation. J. and L. labor problems and LTV's other subsidiaries, Braniff, Okonite, LTV Electrosystems, Ling Altec, and Wilson Sporting Goods Company contributed to LTV's total loss. (Ref 43:136, 41:275) Six of the Fortune top fifty corporations recorded sales declines in 1969. Of these six, Lockheed was in Group H and had a loss. The other five firms, Chrysler, McDonnell Douglas, Boeing, General Dynamics, and United Aircraft were all in Group L. Twenty-six other companies also reported lower sales. AVCO, in Group L, was one of these and had a sales reduction of one-fourth, which was the largest that year. Profit yields for the very largest companies were poor and profit margins dropped dramatically. (Ref 6:182) The above conditions explain why the 1969 mean for Group O increased $1.8 million while the means of both Groups H and L fell rapidly. Since Group H consisted of only three companies in 1969, all graphs and associated tables of profit ratios give data both with and without

Lockheed's deficit.

Return on Sales

The graphs of the average return on sales for Groups O, L and H are plotted in Figure 3. The return for all durable goods manufactured, listed by the SEC-FTC, is also plotted for an additional comparison. The graphs of the variance of Groups O and H are plotted in Figure 4. The data for both figures are contained in Table X.

Return on sales is the ratio of net profit to sales dollars. The Fortune Directory and SEC-FTC listing include many types of industrial groupings. Groups O and the SEC-FTC tend to include most of these types because of their larger size while Group H includes fewer. Return on sales differs considerably from industry to industry and therefore does not provide the best comparison of profitability for this macroscopic analysis. The graph for Group O in Figure 3 is parallel to and about one per cent higher than the graph of SEC-FTC firms. The influence of large deviations about the mean of various sized groups is confirmed in Figure 4. Group H has a smaller but more erratic variance as compared with the wider and more stable variance of Group O.

A "significant step magnitude" occurs in 1962 at the beginning of the "incentive environment." This step is largely explained by the transition of Group H from the two previous deficit years to a year without deficits. A two-thirds reduction from the group's previous variance also

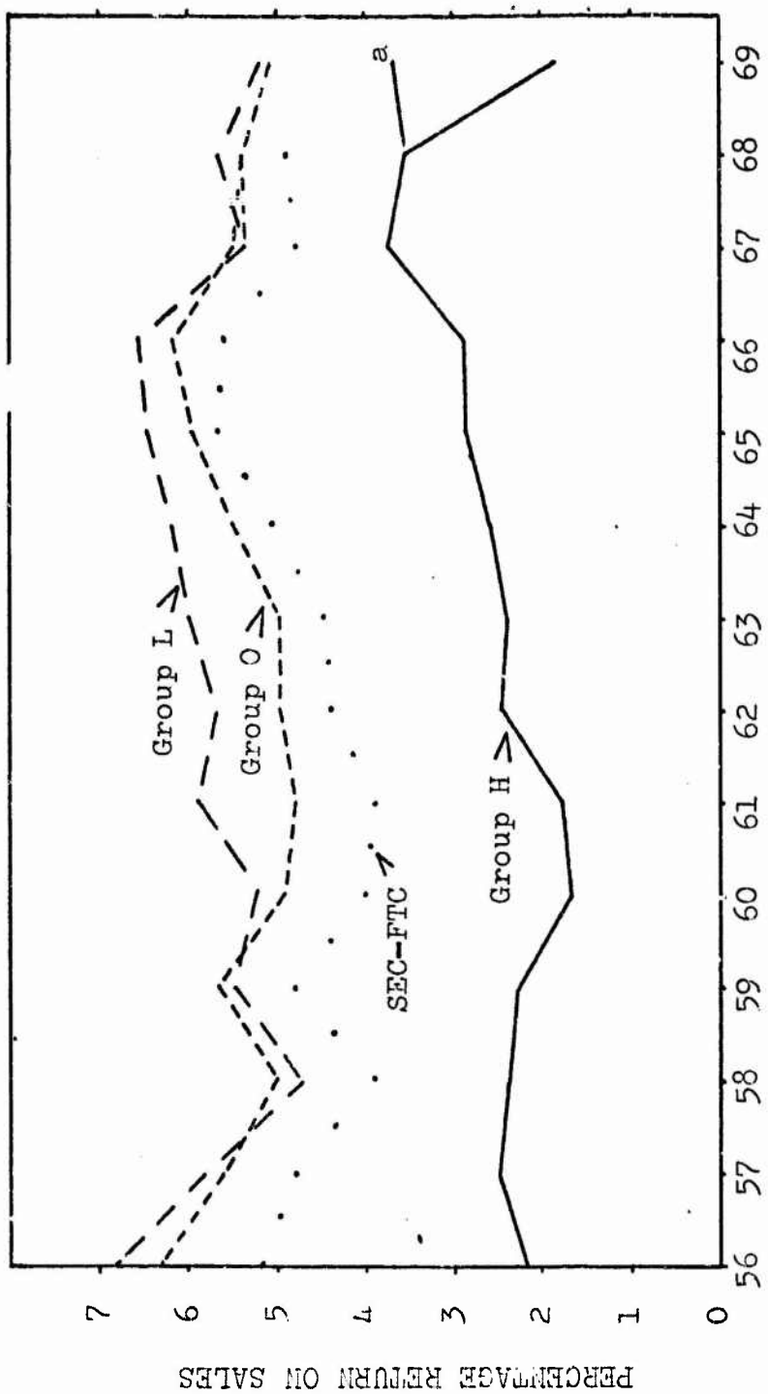

Figure 3. Annual Average Return on Sales for Groups O, L, H, and SEC-FTC Firms.

Source: Data from Table X.

[a]With Lockheed Data excluded in 1969.

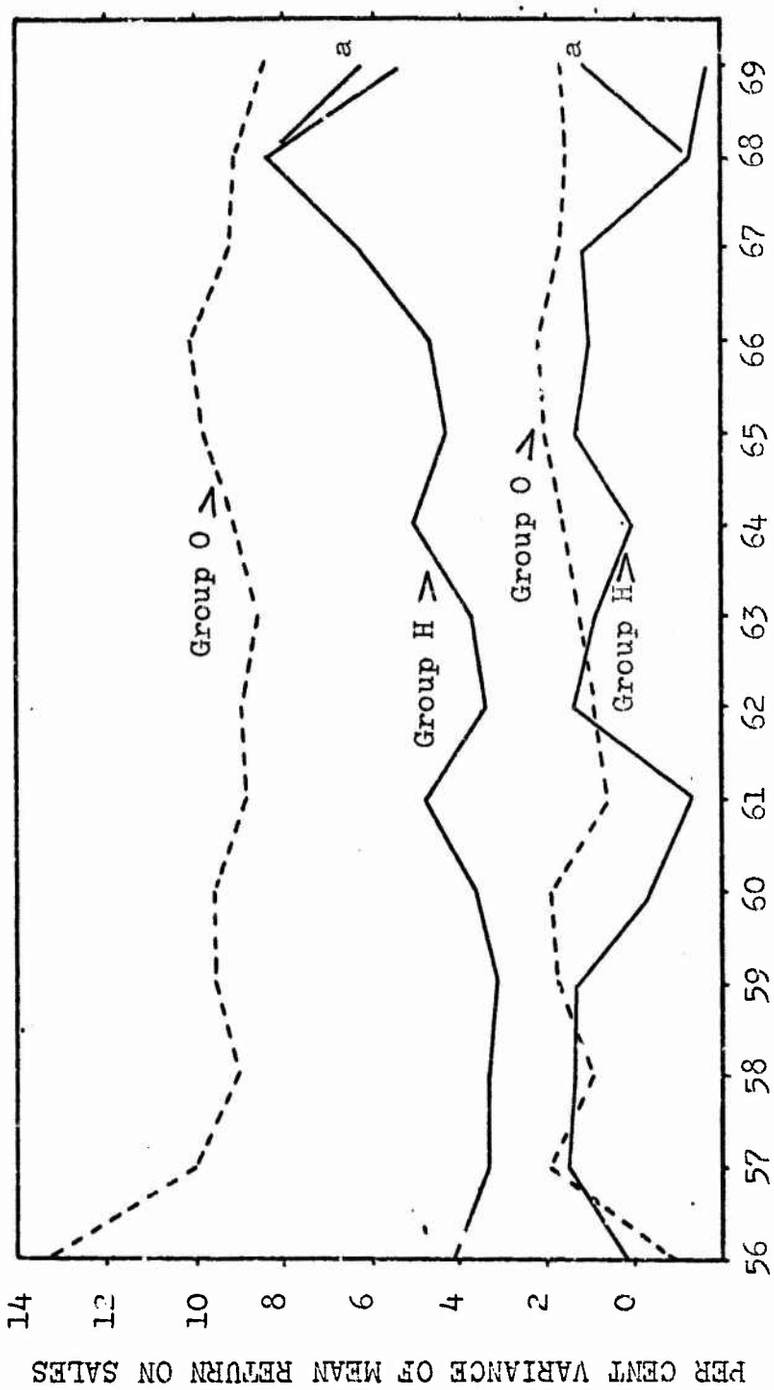

Figure 4. Variance of Annual Average Return on Sales for Groups O and H.

Source: Data from Table X.

[a]With Lockheed Data excluded in 1969.

Table X

ANNUAL AVERAGE RETURN ON SALES FOR GROUPS O, L, H, AND THE SEC-FTC DURABLE GOODS FIRMS

Average Return on Sales by Year														
Group	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
O	6.3%	5.6%	5.0%	5.7%	4.9%	4.8%	5.0%	5.0%	5.5%	6.0%	6.2%	5.5%	5.4%	5.1%
L	6.8	5.8	4.7	5.5	5.2	5.9	5.7	6.0	6.2	6.5	6.6	5.4	5.7	5.2
H	2.2	2.5	2.4	2.3	1.7	1.8	2.5	2.4	2.6	2.9	2.9	3.8	3.6	1.9 3.7[a]
SEC-FTC[b]	5.2	4.8	3.9	4.8	4.0	3.9	4.4	4.5	5.1	5.7	5.6	4.8	4.9	
Variance of the Mean by Year (One Standard Deviation)														
Group	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
O	7.1%	4.0%	3.9%	3.9%	4.7%	4.1%	3.8%	3.7%	3.6%	3.9%	4.0%	3.7%	3.7%	3.4%
L	4.3	4.6	4.2	4.0	4.2	3.9	3.9	3.9	4.1	3.7	3.7	3.3	3.2	3.4
H	2.0	9.0	1.0	0.9	2.0	3.0	1.0	1.4	2.5	1.5	1.8	2.5	4.8	3.5 2.5[a]

[a]Figures computed with Lockheed's financial data (deficit) excluded.

[b]Source: SEC-FTC, Quarterly Financial Report for Manufacturing Corporations. (Ref 71)

occurs in 1962 which considerably strengthens the mean. The H Group per cent return increases 0.5 above Group O's and thereby, according to the established criteria, is clearly a significant step.

The largest "significant step magnitude" occurs in 1967 concurrently with the sharp decline in the other group returns. Fortune reported that the 1967 Industrial 500's sales increase was only 8 per cent above the previous year and that this was the lowest increase since 1963. Net income declined for the first time in six years. (Ref 46:186) Groups L and H each show average sales dollar increases which are only one-half that of the 500's, while Groups O's is slightly greater than the 500's. The average net income for Groups O and L is declining while Group H has a 16 per cent increase. These conditions cause a sharp decline in the average return on sales for Groups O, L, and the SEC-FTC. The extremely high return for Group H results from the combined low sales and record profits which were mentioned previously. One of these firms had a return of over 10 per cent which alone increased the group mean an additional 0.5 per cent.

Another "significant step magnitude" would occur in 1969 if Lockheed's deficit were excluded. This step is very questionable, however, since the group size would then be two. With Lockheed data included, 1969 is a large "opposing step", also questionable for the same reason. All of the other years in the incentive environment period have

"opposing steps" of various magnitudes.

The "incentive steps" have not produced a general trend which equals or surpasses the trend of Group 0 within the 1962-1969 period. Therefore, the "incentive environment" appears to have had no apparent influence on the return on sales trend for predominantly government contractors. The hypothesis is not strongly supported by this profitability indicator.

The U.S. General Accounting Office states:

> Ratios of profit to sales or costs are important to management for comparing profit margins with those of similar companies. But since cost and sales ratios do not consider the amount of capital used in producing the profit, or the period of time the capital was committed, they are less meaningful than capital ratios. (Ref 72:14)

Fortune states:

> Because the ratio of sales to stockholders' equity varies so widely from one industry to another, the rate of profit on sales is not the fairest yardstick of corporate profitability. A better measure of profitability is the return on capital. (Ref 60: 115)

Return on Equity Capital

Equity capital, net worth, and stockholders' equity are generally synonymous terms for the sum of the capital stock, surplus and retained earnings at the end of a company's business year. Another way of describing these common terms is assets minus liabilities. The return on equity capital, as used in this research, is the ratio of after tax net profit to equity capital. Figure 5 presents graphs of the group returns and Figure 6 shows one standard

deviation from the means of Groups H and O. Detailed data are in Table XI.

The recession years of 1958, 1960 and 1961 drove each group's average return, including the SEC-FTC, to the lowest point during the entire period included in this research. The number of yearly net losses per group and profit declines show similar effects on these group means as for the previously described return on sales.

"Significant incentive step magnitudes" occur in 1962, 1967, and 1969 as was the case for return on sales. There are no "insignificant step magnitudes." All other years have "opposing steps." Group H's deficit-free year in 1962 and the reduction in the variance by three-fourths from 1961 each strengthens the group mean. These two factors are the greatest contributors to the 1962 "significant step."

The "significant incentive step magnitude" in 1967 corresponds to Group H's extremely high profits of that year. The variance of Group H is one-third of the previous 1966 value. Also, there are no deficits in 1967 while one occurs in 1966. These factors have some effect on increasing the group mean. A "significant incentive step magnitude" also occurs in 1969, but is very questionable because of the small number of firms in Group H.

A firm with a return on equity capital of 28 per cent is the highest for Group H in 1967 and is 5 percentage points greater than the next highest return. This was the first year this firm was listed in the Fortune 500 where the

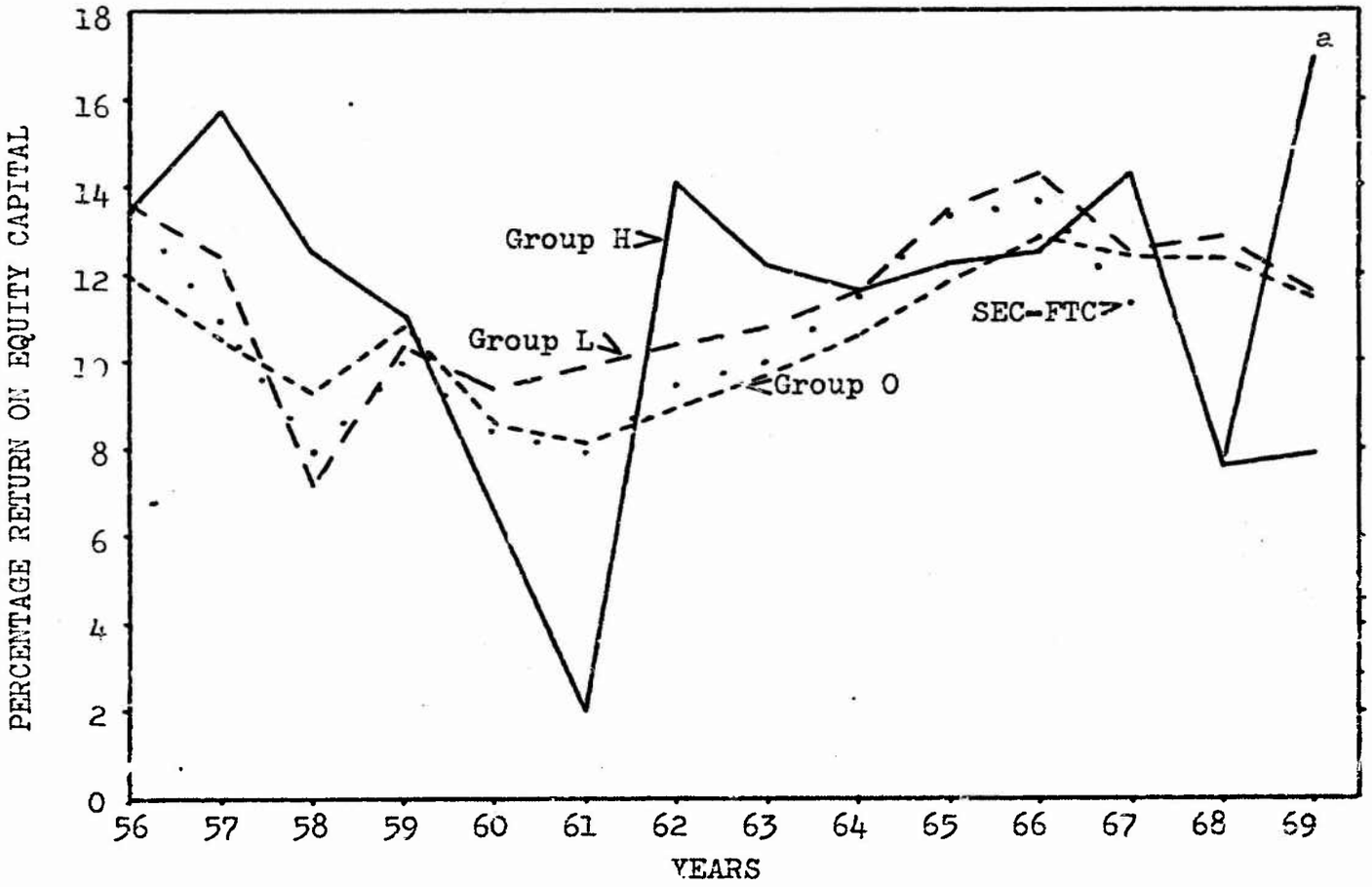

Figure 5. Annual Average Return on Equity Capital-Groups O, L, H, and SEC-FTC.

Source: Data from Table XI.

[a]With Lockheed Data excluded in 1969.

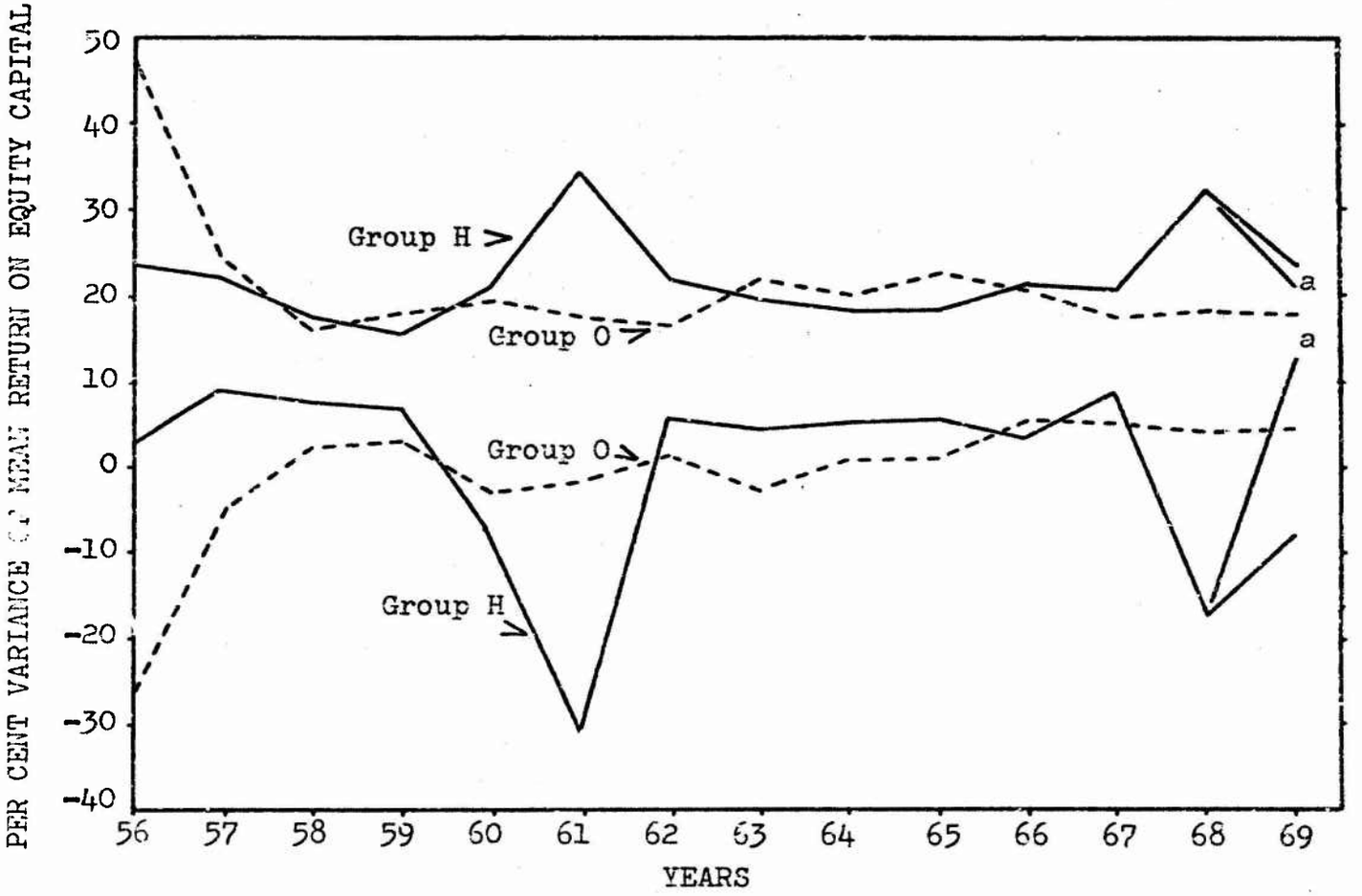

Figure 6. Variance of Annual Average Return on Equity Capital for Groups O & H.

Source: Data from Table XI.

[a]With Lockheed data excluded in 1969.

Table XI

ANNUAL AVERAGE RETURN ON EQUITY CAPITAL FOR GROUPS O, L, H, AND THE SEC-FTC FIRMS

Average Return on Equity Capital by Year														
Group	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
O	12.0%	10.5%	9.3%	10.8%	8.5%	8.1%	8.9%	9.7%	10.6%	11.8%	12.8%	11.3%	11.3%	11.4%
L	13.6	12.4	7.2	10.3	9.4	9.9	10.4	10.8	11.6	13.5	14.3	12.5	12.8	11.1
H	13.4	15.7	12.5	11.2	6.7	2.0	14.0	12.2	11.6	12.2	12.5	14.2	7.5	7.9 16.9[a]
SEC-FTC[b]	12.4	11.0	7.9	10.1	8.4	7.9	9.5	10.0	11.5	13.4	13.7	11.3		
Variance of the Mean by Year (One Standard Deviation)														
Group	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
O	38.5%	14.1%	6.8%	7.4%	11.1%	9.6%	7.5%	12.4%	9.5%	10.8%	7.5%	6.3%	6.9%	6.6%
L	6.0	5.2	14.3	6.4	8.9	4.0	4.7	4.5	6.1	5.6	4.5	4.5	4.0	6.1
H	10.6	6.3	4.7	4.4	14.4	32.7	8.0	7.5	6.6	6.5	9.0	5.9	24.9	15.9 4.1[a]

[a]Figures computed with Lockheed's financial data (deficit) excluded.

[b]Source: SEC-FTC, Quarterly Financial Report for Manufacturing Corporations. (Ref 71)

return was the fourth highest. The firm's large sales increase resulted from munition items for Viet Nam war demands. Dr. Belden reasoned that these sales were not representative of incentive contractual procurement and, therefore, the resulting profits should be omitted. (Ref 3:59) The H Group mean then reduces from 0.14 to 0.13, but remains a very "significant incentive step."

Fairchild Hiller's deficit in 1968 drives Group H's average to a low that is surpassed only by the combination 1960-1961 low. But the 1968 mean fell the largest increment for any individual year and causes the second largest variance of the group's mean. "Opposing steps" also occur in four previous years during the incentive period. One deficit in each of the years, 1965 - 1966, contribute to the opposing steps of those years. There is a general upward trend of the mean for these years which does not exceed Group O's incline.

The "incentive steps" have not countered the "opposing steps" sufficiently, either in frequency or magnitude, to produce a trend for Group H that is increasing relative to Group O. Consequently, the results of this analysis of return on equity capital does not strongly support acceptance of the previously stated hypothesis.

The return on equity capital is of primary interest to the owners or prospective owners of a business. Of greater interest to the government is the return on total capital and return on total assets.

Return on Total Capital

The Logistics Management Institute defines Total Capital Investment in the Defense Industry Profit Review, previously cited, as the sum of equity capital plus long-term debt. William Finan, President of LMI states:

> In LMI's comparison of defense profit on ECI with defense profit on TCI over the period 1958 - 1967, the graphs followed very similar trends. Even with these similar results, LMI recommends that DOD use TCI rather than ECI for setting profit policies for two reasons. First, the use of TCI gives the company the option of raising capital either by borrowing money or selling stock. TCI is not affected differently by either method. Second, a DOD contracting officers' concern is with profit on total assets to be employed on the contract, not with the source of capital used to acquire the assets. (Ref 11:186-187)

The U.S. General Accounting Office defines TCI as the total investment in all assets used in the business, exclusive of any government-owned or leased items. TCI is the equity capital of the owners plus the debt capital provided by creditors. GAO states:

> The percentage of profit earned on TCI is the most meaningful for evaluating defense profits. The Government should not be particularly concerned as to whether contractors obtain capital from stockholders or creditors. Further, since interest is not an allowable cost under government contracts and must be paid from profits, it seems only equitable to consider total capital in determing profits. (Ref 72:12-14)

Fortune publishes corporate data for total assets employed in the business at each company's year end, less depreciation and depletion. This includes government securities held as offsets against tax liabilities. (Ref 61) Current liabilities and long term debt are not listed.

Total assets on a corporate balance sheet must equal total liabilities which includes equity capital, long term debt and current liabilities. Return on total capital investment excludes current liabilities and therefore cannot be computed from this data. Thus, the term "return on investment" is not used in this study.

Return on Assets

The graphs of the group means for the return on assets are presented in Figure 7 while Figure 8 illustrates one standard deviation of the means of Groups O and H. Data for these figures are in Table XII. The graphs of Groups O and L closely compare with that of the SEC-FTC group for the entire period. The means of all the groups dropped during the low profit years of 1958, 1960 and 1961. The means of Groups O, L, and the SEC-FTC declined sharply resulting from the 1967 profit decline. Group H shows a continuously increasing trend from 1963 through 1968.

The Group H increase in 1967, which opposes the other groups' declines, is explained by the high profits of that year. The one firm that Belden excluded in the return on equity capital, discussed previously, had the highest return on total assets for this year. This return of 11.4 per cent was 4.3 percentage points greater than the next highest return. If this firm is again excluded, the H Group mean reduces to .057 which is exactly equal to the previous 1966 value. (Ref 3:59) The mean is then more

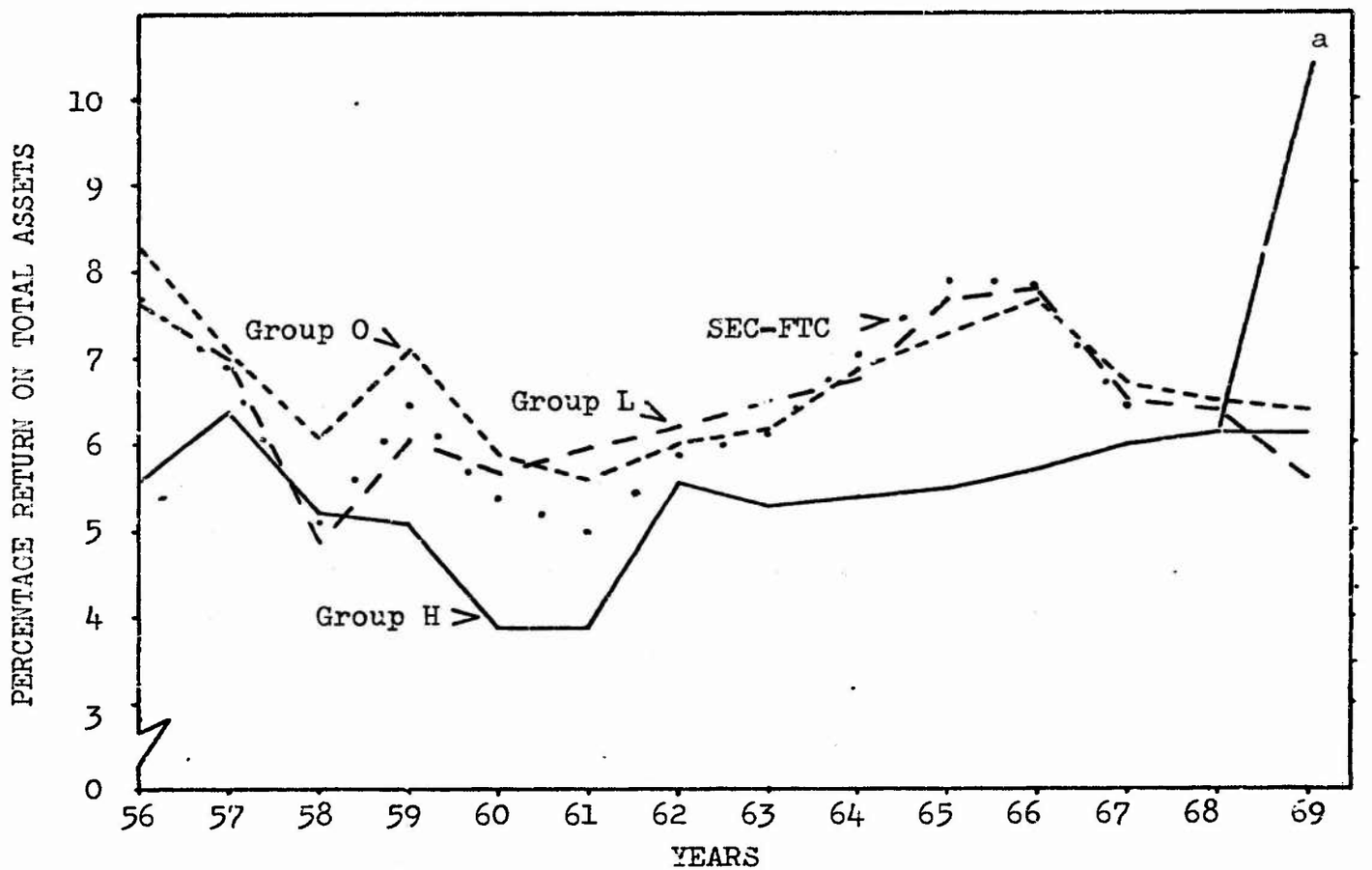

Figure 7. Annual Average Return on Assets for Groups O, L, H, & the SEC-FTC Firms.

Source: Data from Table XII.

[a]With Lockheed Data excluded in 1969.

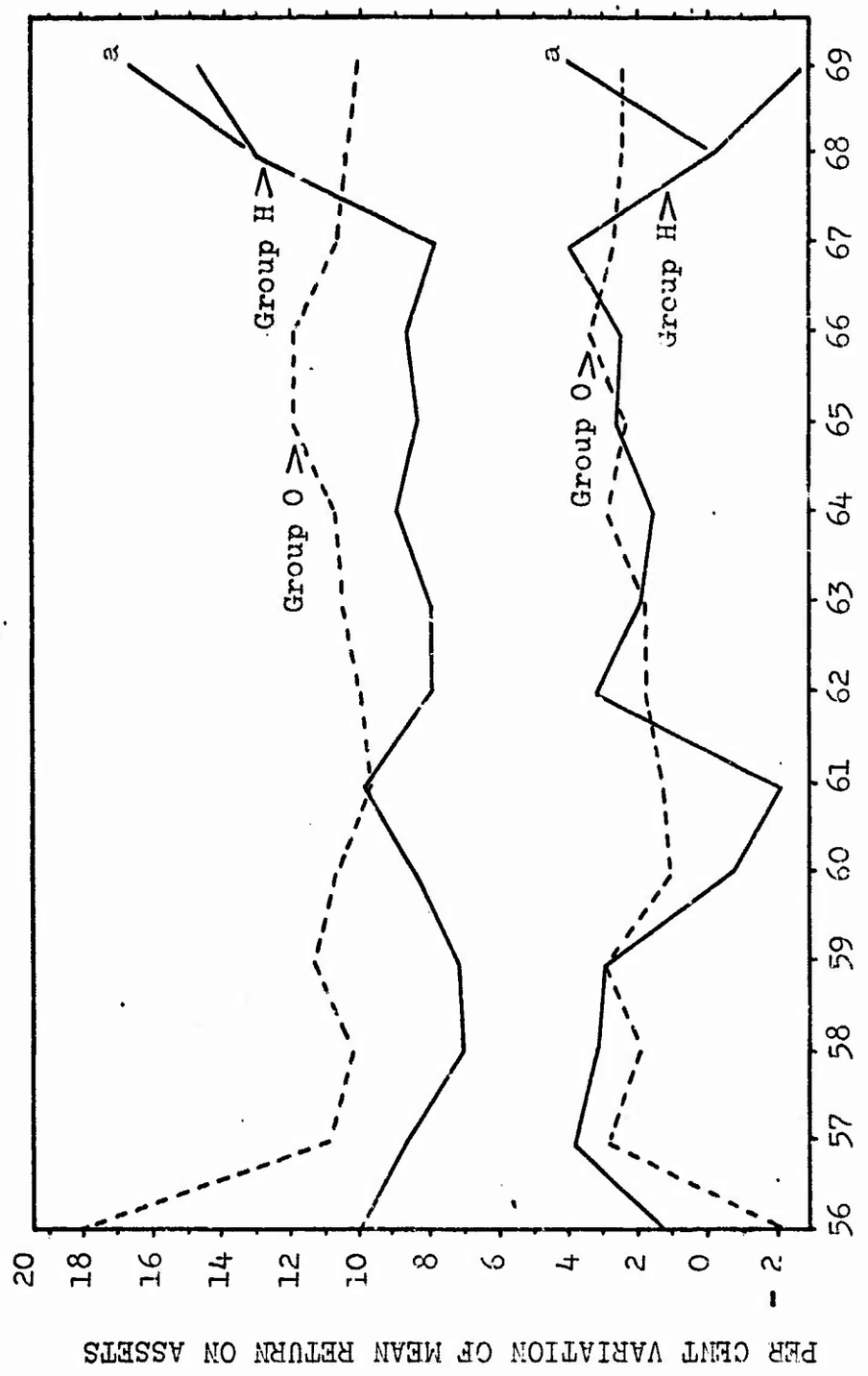

Figure 8. Variance of Annual Average Return on Total Assets for Groups O & H.

Source: Data from Table XII.

[a]With Lockheed data excluded in 1969.

Table XII

ANNUAL AVERAGE RETURN ON ASSETS FOR GROUPS O, L, H, AND THE SEC-FTC FIRMS

Average Return on Assets by Year														
Group	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
O	8.3%	7.1%	6.1%	7.1%	5.9%	5.6%	6.0%	6.2%	6.9%	7.3%	7.7%	6.7%	6.5%	6.4%
L	7.5	7.0	4.9	6.1	5.7	6.0	6.2	6.5	6.8	7.7	7.8	6.5	6.4	5.6
H	5.6	6.4	5.2	5.1	3.9	3.9	5.6	5.3	5.4	5.5	5.7	6.0	6.1	6.1[a] 10.4[a]
SEC-FTC[b]	7.6	6.9	5.1	6.5	5.4	5.0	5.9	6.2	7.0	7.9	7.8	6.4		
Variance of the Mean by Year (One Standard Deviation)														
Group	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
O	10.8%	4.1%	4.2%	4.3%	4.8%	4.2%	4.1%	4.4%	3.9%	4.8%	4.2%	4.0%	3.9%	3.9%
L	3.3	3.5	5.0	3.4	4.5	2.9	3.2	3.2	4.2	3.8	3.2	3.1	2.6	3.1
H	4.4	2.5	2.0	2.1	4.5	6.0	2.3	3.2	3.7	2.9	3.1	1.9	7.0	8.7[a] 6.3[a]

[a]Figures computed with Lockheed's financial data (deficit) excluded.

[b]Source: SEC-FTC, Quarterly Financial Report for Manufacturing Corporations. (Ref 71)

reasonable when compared with the decline of the other groups. By the established criteria, and because of Group O's decline, 1967 still qualifies as a "significant incentive step magnitude."

Other "significant step magnitudes" occur in 1962 and 1968. The step in 1962 is caused by the recovery of Group H from the previous deficit years and a large reduction in the variance from the previous year. The step in 1968 becomes even more "significant" if the firm with the high return in 1967 is excluded. This step is an unusual case since the variance more than doubled the 1967 value. Four firms, including Fairchild Hiller's deficit, are responsible for this increased variance. The remaining firms are clustered near the group mean. Both average profits and average assets were lower in 1968 for Group H than for Group O, but the opposite was the case in 1967. The end result was the Group O mean lost 0.2 per cent while the Group H mean gained 0.1 per cent in 1968.

The "significant incentive step magnitude" in 1969 is explained by another unusual occurrence. The returns of the three firms are widely dispersed and surpass the large 1968 variance. National Presto Industries has a 15% return, Grumman 6%, and Lockheed -3%. The mean also was 6%, so the two extremes exactly cancelled each other. If Lockheed is excluded, the mean return is an enormous "significant incentive step magnitude." In either case, the value of a mean of such a small group, when compared with the larger

Group O, loses significance and creditability. However, deficits contribute to the true overall trends and should not be excluded. By using all of the 1969 data, a steady increasing trend results for the period 1963 through 1969 for Group H. There are four years within the "incentive environment" which produce "opposing steps," caused by Group O's faster rate of increase over H. If only the extreme years of the "incentive environment" 1962 and 1969 are considered, Group H increased by 0.1 per cent more than Group O. But, if 1969 data is excluded, then the average returns of the two groups increased equally over the period to 1968.

By either analysis, the conclusion is that the general trend of Group O is equal to or is increasing at a faster rate than the trend of Group H. Thus, the return on assets trend does not support the previously stated hypothesis. The "incentive environment" has not strongly motivated DOD and NASA contractors toward increased profitability and productivity in the use of total assets relative to the performance of other similarly large commercially-oriented industrial firms.

Asset and Capital Turnover

Capital turnover is frequently used to evaluate a firm's efficiency in the management of capital resources. (Ref 3:63) Asset and capital turnover ratios relate to the previously discussed profit ratios and the returns on sales, equity capital, total capital and total assets

as follows:

$$\text{Equity Capital Turnover} = \frac{\text{Sales}}{\text{Equity Capital}} = \frac{\text{Return on Equity Capital}}{\text{Return on Sales}}$$

$$\text{Total Capital Turnover} = \frac{\text{Sales}}{\text{Total Capital}} = \frac{\text{Return on Total Capital}}{\text{Return on Sales}}$$

$$\text{Total Assets Turnover} = \frac{\text{Sales}}{\text{Total Assets}} = \frac{\text{Return on Total Assets}}{\text{Return on Sales}}$$

Total assets data are used in this research instead of total capital because corporate data on long term debt or current liabilities are not available.

Total Assets Turnover

The annual average total assets turnover ratios are plotted for the three groups in Figure 9. The variances of the annual averages are plotted for Groups O and H in Figure 10. Data for these figures are included in Table XIII. The average of Group O has nearly a constant ratio for the entire period. Group L's average varies considerably more than that of Group O but has a general trend that is nearly constant. The average total asset turnover for Group H has a steadily decreasing trend for the entire research period except 1969. The only "significant incentive step magnitude" occurred in this year. As in previous cases for 1969, the significance of this "incentive step" must not be weighted heavily. The trend of Group H was not altered by the "incentive environment" from the "prior period." The graphs of the variances of the means present the same general trends.

"Insignificant incentive step magnitudes" occur in four

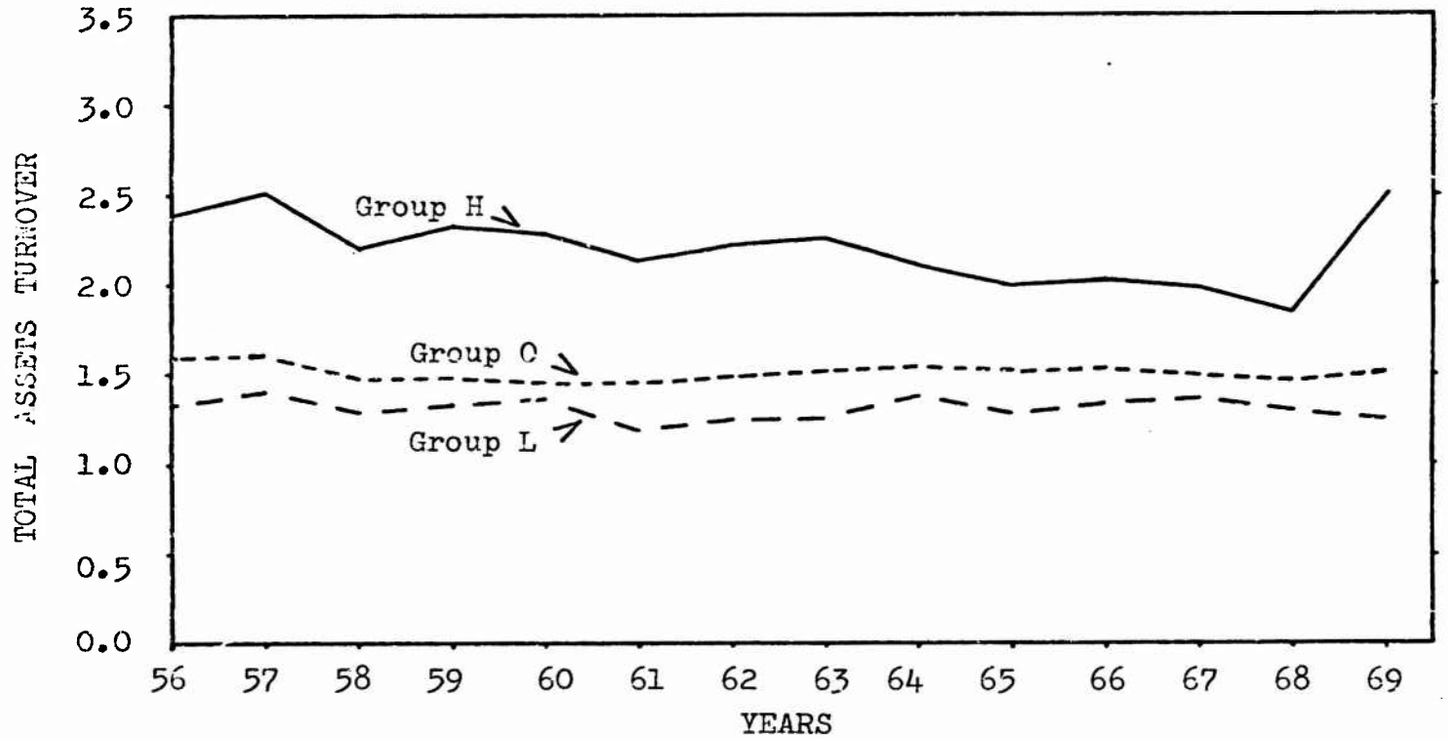

Figure 9. Annual Average Total Assets Turnover for Groups O, L, and H.

Source: Data from Table XIII.

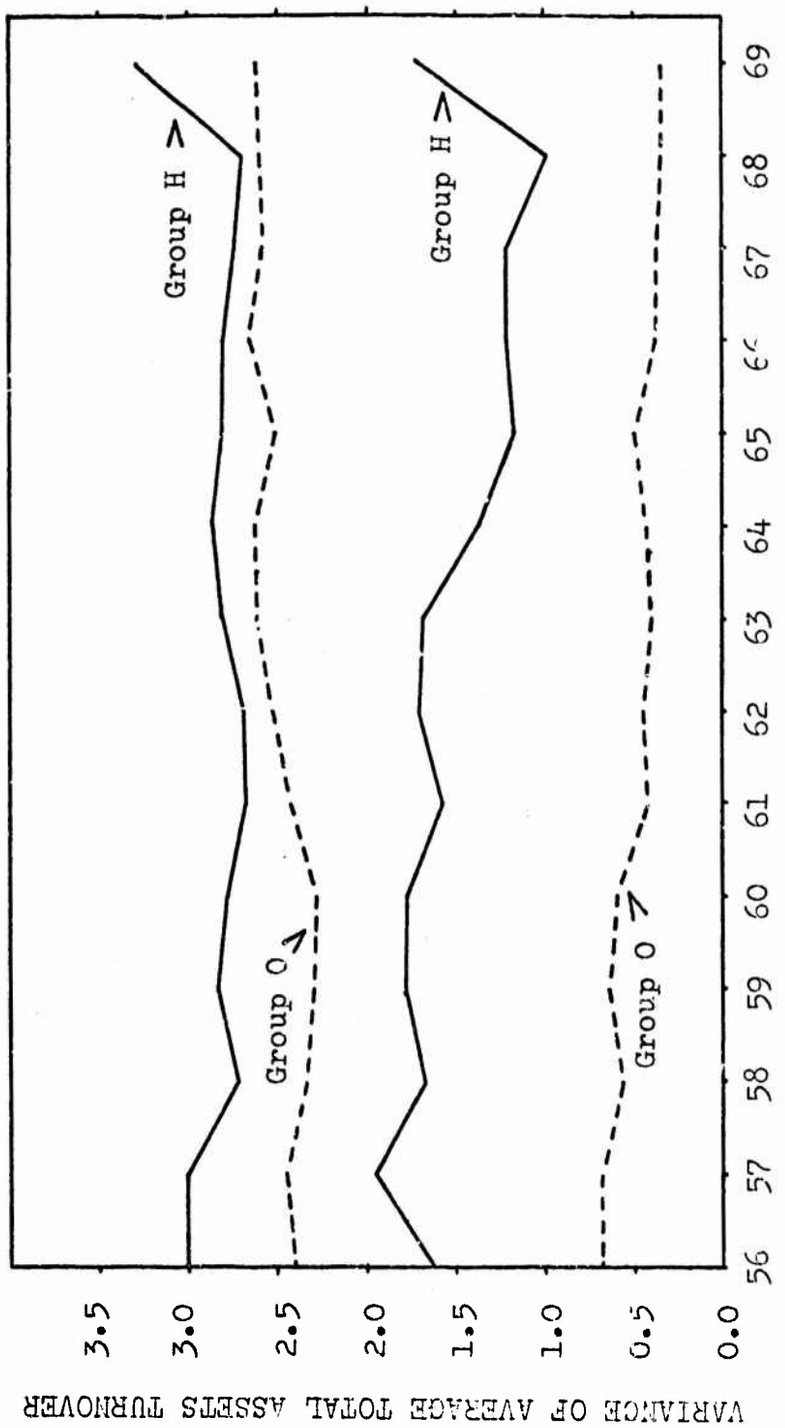

Figure 10. Variance of Average Total Assets Turnover for Groups O and H.

Source: Data from Table XIII.

Table XIII

ANNUAL AVERAGE TOTAL ASSETS TURNOVER FOR GROUPS O, L, AND H

Averages by Year														
Group	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
O	1.58	1.58	1.46	1.48	1.45	1.44	1.49	1.52	1.54	1.51	1.53	1.47	1.47	1.50
L	1.32	1.40	1.28	1.33	1.38	1.18	1.25	1.25	1.39	1.29	1.34	1.36	1.30	1.25
H	2.37	2.50	2.20	2.32	2.28	2.13	2.21	2.25	2.12	1.98	2.02	1.98	1.84	2.50
Variance of the Mean by Year (One Standard Deviation)														
Group	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
O	0.85	0.89	0.89	0.83	0.84	1.0	1.04	1.11	1.09	1.00	1.14	1.08	1.12	1.14
L	0.49	0.52	0.51	0.50	0.52	0.42	0.48	0.51	0.67	0.39	0.44	0.43	0.54	0.44
H	0.73	0.54	0.52	0.52	0.49	0.55	0.48	0.56	0.75	0.81	0.81	0.76	0.86	0.79

of the years. Two of these, 1962 and 1967, correspond with "significant incentive step magnitudes" for the previously discussed returns on sales and assets. These "significant steps" did not affect the turnover ratios since profit is not considered. The other two years, 1963 and 1966, have "opposing steps" for the previous returns. Both Groups O and H had greater increases in sales than increases in assets.

There are no valid "significant incentive step magnitudes," and "opposing steps" occur equally as often as "insignificant incentive steps." These facts do not clearly support acceptance of the previously stated hypothesis based on total assets turnover.

Equity Capital Turnover

Equity capital turnover graphs are plotted for all groups in Figure 11. The variances of the annual averages for Group O and Group H are displayed in Figure 12. Data for these figures are included in Table XIV.

Group H again has a general decreasing trend for equity capital turnover as was the case for the total assets turnover graphs. The trend appears to decrease at a faster rate in the "incentive environment" than in the "previous period." Groups O and L both have slightly increasing trends during the 1960's and the respective variances indicate similar trends.

There is no change in the step magnitude from 1961 to

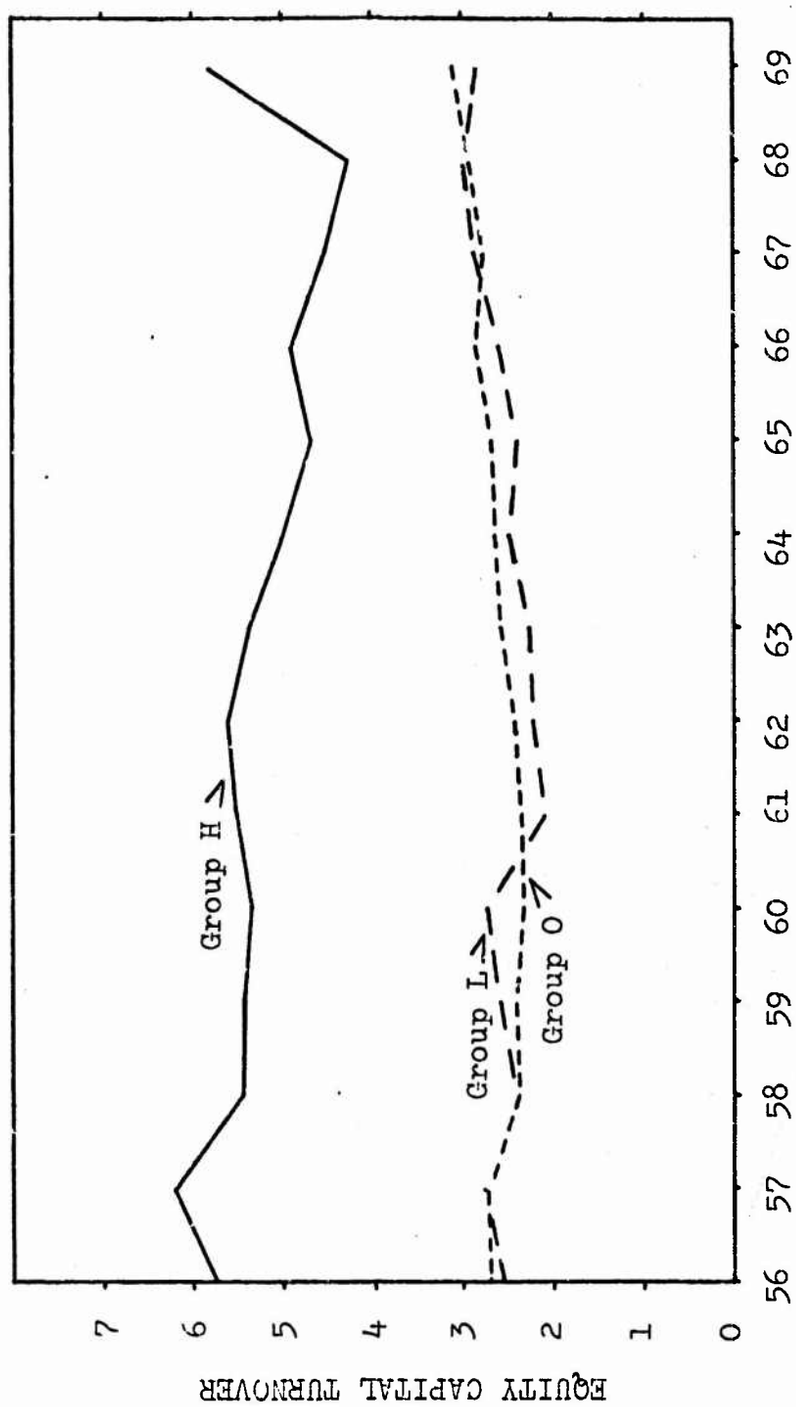

Figure 11. Annual Average Equity Capital Turnover for Groups O, L, and H.

Source: Data from Table XIV.

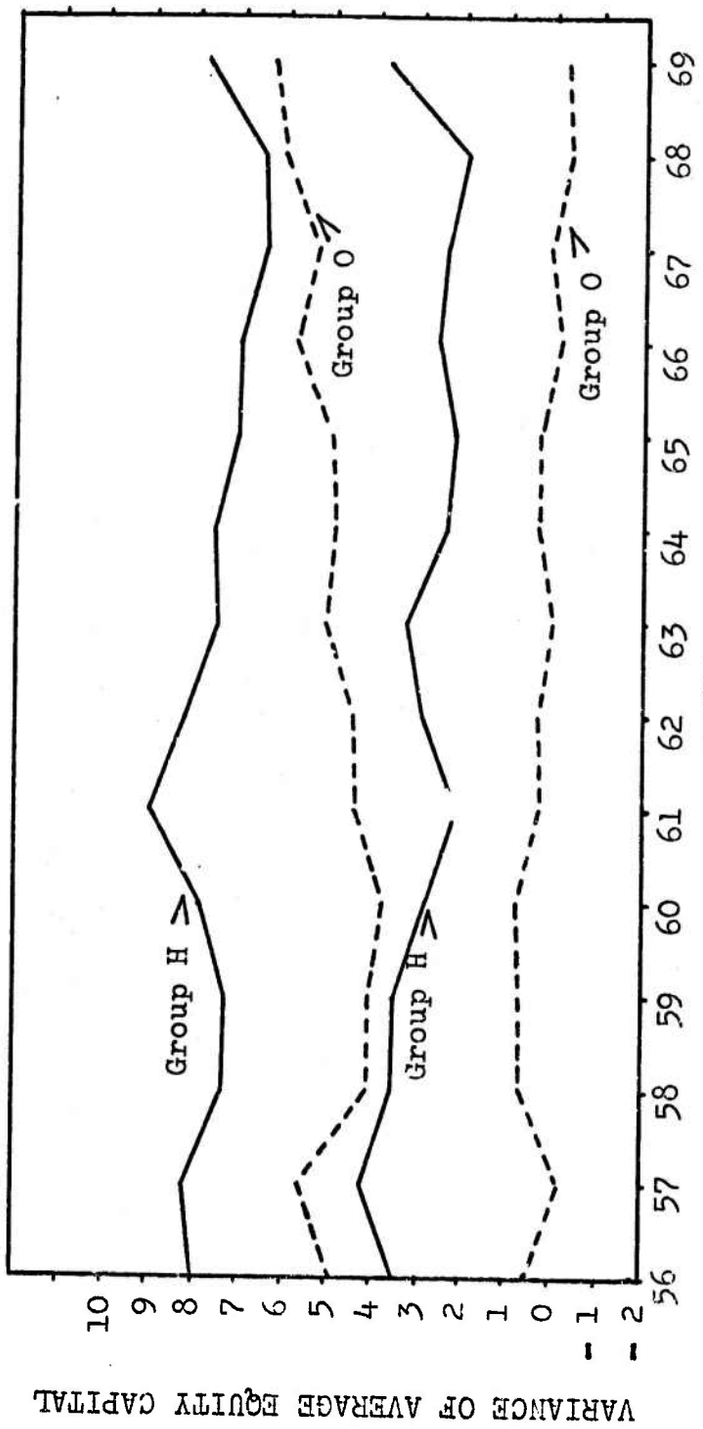

Figure 12. Variance of Average Equity Capital Turnover for Groups O and H.

Source: Data from Table XIV.

Table XIV

ANNUAL AVERAGE EQUITY CAPITAL TURNOVER FOR GROUPS O, L, AND H

Averages by Year														
Group	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	19	1969
C	2.70	2.74	2.38	2.41	2.33	2.35	2.43	2.60	2.64	2.70	2.88	2.77	2.93	3.09
L	2.55	2.76	2.39	2.60	2.72	2.08	2.23	2.28	2.51	2.40	2.61	2.89	2.96	2.85
H	5.76	6.20	5.44	5.43	5.35	5.53	5.61	5.37	5.01	4.68	4.91	4.52	4.29	5.86

Variance of the Mean by Year (One Standard Deviation)														
Group	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
O	2.17	2.90	1.70	1.69	1.53	2.08	2.07	2.58	2.26	2.32	2.99	2.62	3.23	3.30
L	1.40	1.67	1.52	1.52	1.67	0.91	1.00	1.20	1.50	0.86	1.16	1.46	2.17	1.78
H	2.18	1.97	1.86	1.83	2.52	3.46	2.64	2.10	2.61	2.43	2.18	1.98	2.26	1.99

1962. An "insignificant step magnitude" occurs in 1966. The usual "significant incentive step magnitude" appears in 1969. But, as in previous cases, this step must not be considered of great consequence. All other years produce "opposing steps."

The stated hypothesis is not supported by the trends of equity capital turnover of Group H relative to Group O. Also, the faster rate of trend decrease within the "incentive environment" relative to the "prior period" does not support the motivational theory of incentive contracting.

Sales Dollars Per Employee

Sales dollars per employee is an efficiency measure of a firm's management of labor resources. The graphs of the group averages are presented in Figure 13. The variances of the means are not plotted since the data as listed in Table XV indicates stability for both Group O and H. The means of both Group O and Group H illustrate continuously increasing trends for the entire fourteen year period. Group H is nearly parallel and ten dollars per employee less than Group O for this period.

The first five years of the "incentive environment" show "opposing steps." A "significant incentive step" occurs in 1967. This step is caused by the lower sales dollar increase of Group H relative to Group O, mentioned previously. "Insignificant incentive step magnitudes" occur in 1968 and also in 1969, providing Lockheed's data

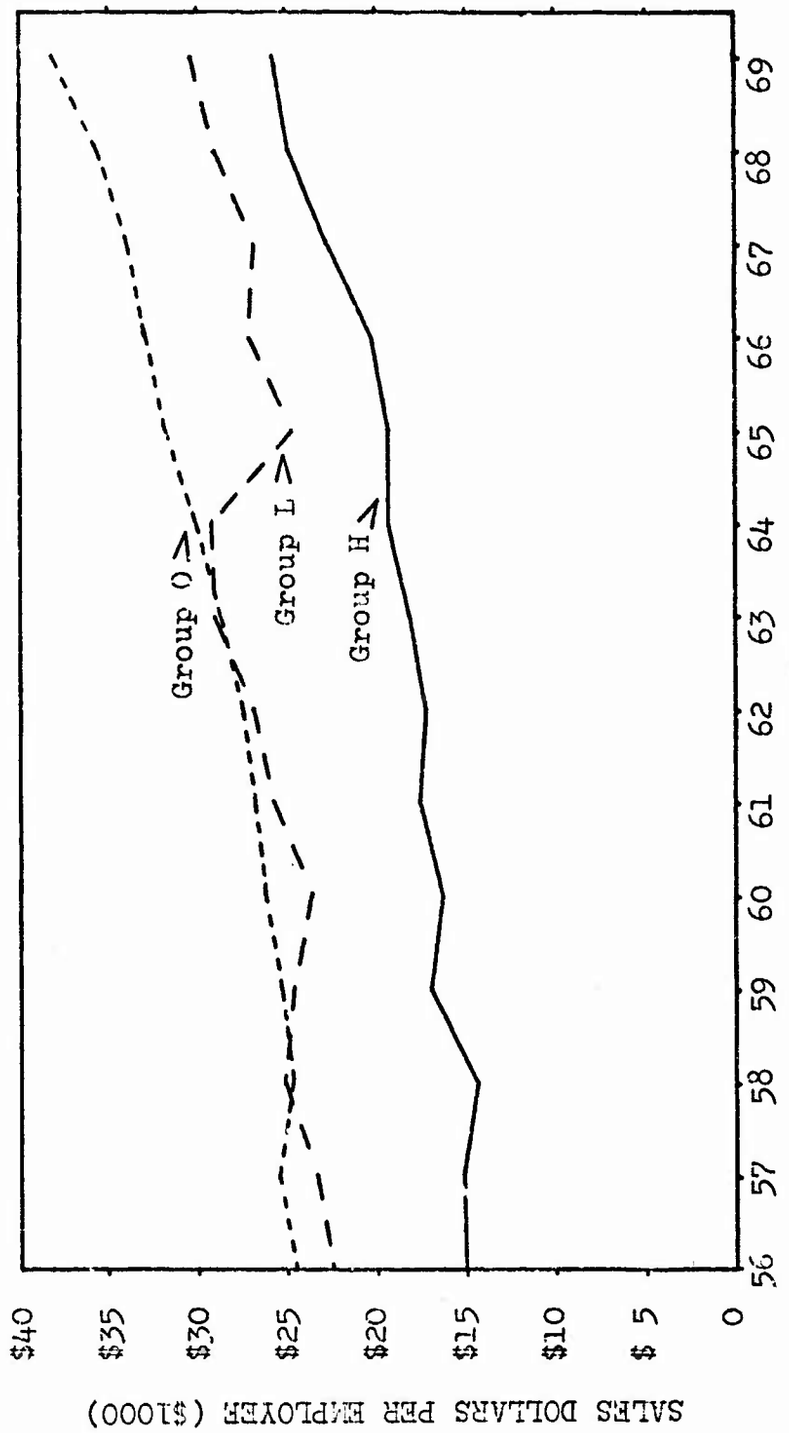

Figure 13. Annual Average Sales Dollars per Employee for Groups O, L, and H.

Source: Data from Table X.

Table XV

ANNUAL AVERAGE SALES DOLLARS PER EMPLOYEE FOR GROUPS O, L, AND H ($000)

Averages by Year														
Group	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
O	$24.7	$25.5	$24.9	$25.3	$26.1	$26.8	$27.5	$28.9	$30.1	$31.8	$33.0	$33.8	$35.7	$38.3
L	22.5	23.3	25.1	24.8	23.7	25.9	26.9	29.0	29.3	24.8	27.3	26.9	29.2	30.5
H	15.0	15.2	14.5	17.1	16.4	17.7	17.3	18.2	19.3	19.4	20.2	22.7	24.9	25.7

Variance of the Mean by Year (One Standard Deviation)														
Group	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969
O	$28.5	$25.6	$19.9	$17.3	$15.8	$19.4	$19.4	$22.3	$21.6	$23.8	$25.9	$28.0	$28.8	$36.1
L	13.9	15.3	16.0	16.1	13.5	15.5	15.2	18.4	17.3	14.1	15.6	16.0	16.5	18.0
H	7.3	3.1	2.7	3.7	3.3	3.6	3.2	3.0	3.0	3.9	4.1	4.6	5.8	7.8

are excluded. An "opposing step" results when Lockheed is included in Group H in 1969.

The graphs clearly show an opposing trend within the "incentive environment" from 1962 to 1966. There is a possibility that a trend favorable to the "incentive environment" exists since 1967. The doubtful value of the 1969 Group H average makes such a determination uncertain. However, the Group H trend after 1966 does show a substantial change in slope relative to the previous ten-year trend. Group O produces a similar trend change that occurred earlier in 1964. The trends of Group H and Group O are nearly parallel for the final three years.

The conclusion is that since both groups have had a similar change in trends, the "incentive environment" probably has not contributed to the trend change in the Group H mean. At best, the trend of Group H only parallels that of Group O. The increased use of incentive contracting has not improved the DOD and NASA contractors' efficiency in the use of labor resources relative to that of similar commercial industrial corporations. Thus, the results of this analysis of sales dollars per employee trends does not support acceptance of the previously stated hypothesis.

Summary

The increased use of fixed-price and incentive contracts has not apparently motivated defense and NASA contractors toward increased managerial efficiency in the use of capital

and labor resources. The analyses of all efficiency, profitability and productivity indicators used in this research produce trends which do not support acceptance of the hypothesis. This is based on the annual analyses and trend comparisons of Group H relative to Group O. The analyses of the Group H trends within the "incentive environment" relative to the "prior period" also contribute to this position. The additional years gained by this extended research are helpful in evaluating the uncertainty of the final year's data in Belden's previous study. However, because of the very limited size of Group H in 1969, this research period terminates with even more uncertainty.

IV. Conclusions and Recommendations

Conclusions

The Department of Defense and NASA's emphasis on shifting government procurement methods from cost-plus-fixed-fee to greater use of fixed-price and incentive contracts has been successful in obtaining a more favorable balance of contract types. The increased profit potential which is inherent in firm-fixed-price and incentive contracts is accompanied by a similar potential for risks. These risks include the possible reduction or cancellation of programs, advanced technology unknowns, changing weapon system characteristics, and many others. To reduce the risks associated with defense and NASA procurement industrial firms have diversified in the form of mergers, acquisitions, and the addition of commercial product lines. These firms may receive the same share of government business as previously, but because of the diversification the government sales revenues represent a smaller percentage of total sales for an individual firm. This trend indicates that large industrial government contractors are maintaining the same or a larger share of the total government procure-

ment dollars, but are also diversifying to reduce the risks involved in order to keep this business. The diversification trend is evidenced in this research by the steadily declining group size of the firms with over 50 per cent of total sales revenues from government sales. In 1969 only three firms remained in this group.

The data from the Group H firms in 1969 does not support strong conclusions about the performance of defense and NASA contractors in that year. A group of three firms, which includes one with a large deficit, does not produce valid group averages for comparison. This extended research resolved the uncertainties of the final year in Dr. Belden's previous study caused by the overall sales and profit declines of 1967. One additional year of valid data is also included in this research. The methodology of this macroscopic analysis is no longer feasible if the number of firms individually receiving over 50 per cent of total sales revenues from government sales continues to decrease as the current trend indicates.

The Government's emphasis on incentive contracting has intensified the "incentive environment". But, the macroscopic analysis methodology used in this research reveals that the intended purpose of motivating defense and NASA contractors toward increased managerial efficiency in the use of resources has not been achieved. Firms receiving over 50 per cent of their total sales

revenues from DOD and NASA have not exceeded the financial performance of similarly large industrial firms that have no government sales. The results of the analyses of the financial indicators taken collectively do not produce strong justification for accepting the hypothesis that incentive-type contracts motivate managerial efficiency in the use of capital and labor resources.

Recommendations

The findings of a macroscopic analysis, such as in this research, do not reveal the entire success or failure of incentive contracting. The results of this research should be supplemented by a microscopic analysis covering the same period. The microscopic analysis examines the profit on individual contract outcomes and profits resulting from the various contract types.

This research methodology of group comparisons, based on the percentage division of 50 per cent of sales revenues from DOD and NASA, obviously cannot be used for further macroscopic research because of the reduced group size. However, further macroscopic studies could be conducted using questionnaires to solicit financial information from government contractors. This technique was used in the two profit studies by the Government Accounting Office and the Logistics Management Institute.

A particular suggestion for further research is to determine the effects of the intensified "incentive

environment" upon a group of smaller contracting firms in a comparison with a group of larger government contractors. The group of large contractors could be similar to the combined two groups used in this research. The group of smaller-sized firms could include prime and subcontractors with considerably less total sales revenues than the giant industrials.

Finis

Several recent studies by both industry and government agencies were designed and conducted to improve the defense and space systems acquisition process. Many of these are cited in this research. These and many other studies have been directed toward the continuous improvement of the defense and space acquisition process. The intent of this research has been to similarly contribute to that improvement.

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Appendix A

Defense Procurement

Formal Advertising

The Government prepares an Invitation for Bid (IFB) which clearly describes the requirements. The IFB is distributed to prospective bidders, who are listed on bidders' lists. Also the IFB is publicized by other means. Interested contractors submit sealed bids, which are publicly opened. The contract is awarded to the responsible bidder submitting the bid most advantageous to the Government, price and other factors considered. Contracts awarded through formal advertising are usually firm fixed-price or fixed-price with an escalation clause. (Ref 66:45)

Two-Step Formal Advertising

This procurement method was included in Revision No. 1 to the 1960 edition of the Armed Services Procurement Regulation (ASPR). The first step consits of the request, submission, evaluation, and the possible discussion of a technical proposal, without pricing, to determine the acceptability of the supplies or services. The second step consists of formally advertised procurement, but is confined to these offerors who submitted an acceptable technical proposal in step one. This procurement technique may be used when all of the following conditions are present:

1. Lack of definite or complete specifications to permit full and free competition.
2. Availability of definite criteria for evaluating technical proposals.
3. Expectation that more than one technically qualified source will be available.
4. Sufficient time is available for this two-step-method.
5. The use of a firm fixed-price or fixed-price with escalation contract. (Ref 66:46-47)

Negotiation

> The Government sends a Request for Proposal (RFP) or Request for Quotations to prospective bidders. Negotiation is distinguished from formal advertisement by two essential differences: the bids are not opened in public and the Government is not required to make the award to the lowest bidder. (Ref 36:2)

Types of Governement Contracts

Firm Fixed-Price (FFP)

The Government and contractor agree to specific fixed prices to be paid the contractor for definite supplies, products or services. The contractor's profit or loss is the difference between the fixed price and actual cost. The contractor is entirely responsible for cost overruns and also would receive 100 per cent of the profit from a cost underrun. This is defined as a 0/100 sharing ratio. In the ratio, the numerator is the Government's share and the denominator is the contractor's share of any profit, risk or loss on the contract.

Fixed Price With Escalation

This is basically a fixed-price contract but allows for an adjustment of the stated contract price when certain contingencies occur. These contingencies are specifically defined in the contract and are events beyond the control of the contracting parties. (Ref 36:79)

Fixed-Price-Redeterminable (FPR)

> There are several forms of the FPR contract. In the prospective price redetermination form, the price is renegotiated at certain intervals during the contract life. The retroactive redetermination contract renegotiates the price at contract completion. The other forms are combinations of the prospective and retroactive. (Ref 49:4)

Fixed-Price-Incentive (Firm Target) (FPIF)

The FPIF contract has a negotiated initial target cost, target profit, price ceiling and a formula for establishing final profit and price. At contract completion, the final cost is negotiated and the final price is established with the formula. (Ref 66:49)

Fixed-Price-Incentive (Successive Targets) FPIS)

> The FPIS contract has a negotiated initial target cost, initial target profit, price ceiling, a formula for fixing the firm target profit, and a production point at which the formula will be applied. The production point is generally fixed at a time prior to delivery or shop completion of the first item. At this point the firm target cost is negotiated and the firm target profit is automatically determined by the formula. At this point a firm fixed-price may be negotiated or a formula for establishing final profit and price may be negotiated using the firm target profit and the firm target cost. The final cost is negotiated at the completion of the contract. The final contract price is then computed by the formula for establishing final profit and price. (Ref 66:49)

Cost-Plus-Fixed-Fee (CPFF)

All actual costs allowable by the ASPR are reimbursed by the Government. The CPFF contract has an established fixed fee that is normally negotiated as a

percentage of the target cost. The sharing ratio is 100/0.

Cost-Plus-Incentive-Fee (CPIF)

The CPIF contract has an initial target cost, target fee, a minimum and maximum fee, and the fee adjustment formula or sharing ratio, such as 80/20.

Performance and Schedule Incentives

Performance incentives provide for increases or decreases in fees or profits when performance characteristics such as range, speed, engine thrust, maneuverability, versatility, operational economy, payload, and other desired qualities are achieved at specified levels.

Schedule incentives provide for monetary rewards and penalties for being ahead of scheduled events or failure to meet scheduled events.

Appendix B

Renegotiation

History of Renegotiation

There have been many and various attempts to prevent excessive profit making from national defense emergencies throughout the history of government contracting. During World War I excess profits taxes were used. The Vinson-Trammel Act and The Merchant Marine Act were adopted in the mid-1930's to limit the profits of aircraft, and naval and merchant vessel producers to a specified percentage.

> The Vinson-Trammel Act applies to government contract awards of over $10,000. This Act required contractors to repay all profit in excess of 10 per cent of the total contract price of ships and all profit in excess of 12 per cent for the total contract price of aircraft. This limitation applies to the aggregate contract prices of all contracts completed during the taxable year.
>
> The Merchant Marine Act of 1936 required that profit in excess of 10 per cent of the total contract price of merchant vessel construction as was completed within the income taxable year would revert to the Government. (Ref 17:155-156)
>
> During World War II profits of defense contractors were controlled through Executive Order limitation and price adjustment boards and later by The War Contracts Price Adjustment Board. Peace time control of profit was established by the Renegotiation Act of 1948. This Act required the renegotiation of all defense contracts for more than $1,000 by a contractor performing total contracts of $100,000 or more. The original act also applied to contracts with other government agencies having a direct and immediate connection with the national defense as the President might designate. The Secretary of Defense had the authority to renegotiate and reprice in the event of excess profits.

The Renegotiation Act of 1951, the currently effective law, is based upon the principle of flexible renegotiation of profits rather than a fixed percentage or formula. Its objective, like previous laws, is to eliminate excessive profits derived by contractors and subcontractors in connection with the national defense program. After considering allowances of certain costs, the amounts of profit are determined to be excessive on the basis of the capital employed, the character of the business, the contribution to the defense effort, the risk assumed, the efficiency of the contractor, and the reasonableness of costs and profits compared with non-defense business. (Ref 17:121)

Renegotiation Boards

The Renegotiation Act of 1951 established the Renegotiation Board and its Regional Board as an independent organization of the executive branch of the Government. The Board gained some of the powers formerly exercised by the War Contracts Price Adjustment Board. The Secretary of Defense delegated to the Board his authority to renegotiate which was conferred on him by the Renegotiation Act of 1948. The Secretaries of the Army, the Navy, and the Air Force, (with Secretary of Defense approval) and the Administrator of General Services each recommends for the Board, one civilian for the President's consideration. The President appoints five Board Members, by and with the consent of the Senate and designates one as chairman. (Ref 17:121)

Vita

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